Millennia TD-1 and STT-1 Origin Recording Channels

***By* Tom Bowlus**

There was a time when the bass rigs available on the market had definite and specific frequency ranges in mind, and typically weren't very good at reproducing frequencies outside of that range. As the understanding of electric bass and its possibilities developed, the "bass" came to be seen more and more as a full-range instrument. This, in turn, led to bass rigs which performed better over a wider range of frequencies. But for players who wanted to remove any limitations which their amplification system was placing on their instrument and their musical vision, most of the mass-market bass rigs weren't taking them where they wanted to go.

Granted, there are some bass-specific products on the market today which do offer truly full-range performance, with minimal coloration, but many players have found their ideal amplification solution by looking outside of the "bass rig" box. Enter Millennia Music & Media Systems. Founded by John and Cynthia La Grou, Millennia Media originally focused on recording classical music performances in the northern California area. As recording moved on to engineering and manufacturing, John set out to design a microphone preamp that could deliver the highest possible degree of sonic transparency. The success which Millennia Media found with their microphone preamps led them to develop other products, such as dynamics processors and equalizers. What's better for us bass players – and many other instrumentalists – Millennia has packaged many of these high-performance circuits into two different "recording channel" products (you'll be forgiven if you refer to them as "preamps"), the TD-1 and STT-1 Origin. These products aim for nothing short of the ultimate in clarity, transparency and control over your source, whether it's a microphone, instrument, or other line level source. Reading over their specs and feature sets is enough to make a die-hard tech-head drool with anticipation. But how do they *really* work on bass? Let's find out...

One and a Half

Let's get one thing out of the way right up front. The TD-1 and STT-1 Origin are not for every player. For some folks, those "frequency limited" rigs I spoke of are hallowed, vintage rigs with exactly the voice they are looking for. Other players shy away from too many knobs, buttons, and lights, and crave a much more stripped-down and basic setup. But for players who place high value on sonic

fidelity, uncolored amplification, and proper treatment of the instrument signal from start to finish, these recording channels from Millennia are nothing short of amazing.

When the kind folks at Millennia offered to send us an STT-1 Origin for review, I suggested that we make it a double review and include the TD-1. I've been using a TD-1 for years, and it's been an invaluable piece of reference gear – as well as one of my all-time favorite bass "preamps." To prepare for this review, I sent my TD-1 in to Millennia for a thorough go-over to make sure that it was performing up to spec.

The STT-1 and TD-1 are laid out as full rack-space and half rack-space recording channels, respectively. There are numerous shared components/features, but some notable differences, as well. Let's start off by discussing some of the features they have in common. They both offer Twin Topology® initial gain stages. This means you have the choice of routing your signal through either a class-A tube gain stage (12AT7), or a discrete, class-A FET solid state gain stage. If you happen to use a microphone in your rig, they each include the renowned Millennia discrete solid state HV-3 microphone preamp. With regard to EQ, both the STT-1 and TD-1 feature two bands of "mastering-grade" NSEQ-2 parametric EQ. Both units feature unbalanced XLR and 1/4" outs, and balanced XLR outs. Each unit has some unique output options, as well, which we will discuss, below.

What is evident from these shared characteristics is that both the TD-1 and the STT-1 Origin are well-equipped to handle the most demanding amplification needs and make for some great bass preamps. It is tempting to think of the TD-1 as a kind of "STT-1 light," but once you dig into them a bit, you realize that they each bring their own special tricks to the table.

TD-1

This "little black box" (though it's also available in a "platinum" finish) packs a dizzying array of features into a fairly compact package. On the front panel, you have the 1/4" Instrument input and the XLR Line + REAMP® input (the XLR mic pre input is on the back). That 1/4" input is also the Speaker Soak™ input, meaning that you can insert a direct feed from a power amplifier. This opens up some intriguing possibilities, such as taking the output from your tube amp and routing it to another entire rig, or sending it straight to tape (er, disk). Another unique and cool feature of the TD-1 is the ability to select between three different impedance options for the instrument input. The options are 470k ohm, 2M ohm, and 10M ohm, so whether you are packing magnetic pickups or piezos, or even a MIDI instrument (such as a keyboard or sampler), you will be able to match the correct input impedance.

The +48v phantom power switch is located on the front, but it applies to the HV-3 mic input on the back panel. Below this pushbutton switch, we find the Input Ground Lift/Isolate switch. When engaged, it removes the 1/4" instrument input from the internal audio ground (you have the option – via an internal jumper – of selecting either a true ground lift, or "isolation" via

resistive and capacitive coupling). One feature which seems superfluous up until you need it, and invaluable after you eventually do need it, is the Polarity Reverse switch. Moving down, we find a nifty green button which enables the Speaker Soak function (don't plug your amplifier output into that 1/4" jack unless that green button is lit up, or else bad things may happen). At the bottom of this "row" is the Gain control. It is labeled as both +45 and +65, which means that the potentiometer is capable of adding up to 65dB gain for the mic input, and up to 45dB gain for the instrument and line inputs.

Now, we move on to the incredible parametric EQ section. Both channels have their own "In" pushbutton which takes that band in or out of the circuit path. There is also a "global" EQ In switch. The LF EQ band offers a choice of frequency centers from 20Hz to 2.5kHz. The frequency selection knob goes from 20 to 250, and the X10 button predictably bumps the selected frequency up by a factor of 10 (with the total range covering 20Hz to 2.5kHz). The two gloriously big knobs let you dial in 15dB of boost or cut per band. The variable Q control is extremely useful. This allows you to adjust how narrowly, or how broadly, the EQ boost or cut will be applied, relative to the selected frequency center.

The far right-hand row of lights and buttons features three LEDs, which indicate that the power is on, show when a nominal signal is present, and show when the signal at the balanced line level has exceeded +26dBu (maximum output is +32dBu). Below this, we have the previously mentioned EQ In control, the Twin Topology switch, which lets you choose between the tube or solid state topologies, and an Input Select switch, which selects between the Instrument and the Line/Mic inputs. Finally, we have a -20dB Pad switch, which attenuates all inputs.

Switching to the rear panel, the TD-1 features a nifty combined plastic housing which contains the IEC power receptacle, the main fuses, and the power on/off switch. The Earth Lift button affects the internal audio and power ground paths. The earth-to-chassis ground bond, however, is never compromised. The "REAMP I" and "REAMP II" 1/4" outputs are designed to emulate the output characteristics of Stratocaster® style single-coil pickups, and/or Les Paul® style dual-coil humbucking pickups, respectively. Millennia is working on other bass-specific emulation transformers (for Jazz Bass and Precision Bass, and possibly

others), but the REAMP Type II should work fairly well for bass guitar.

If you want outputs, the TD-1's got 'em for ya! It offers both 1/4" and XLR balanced main outputs, as well as 1/4" and XLR unbalanced main outputs. The "BAL XFMR OUT" is the XLR output from the DI-dedicated transformer, which provides a mic-level output and features its own ground lift toggle switch. Above this is the 1/4" Direct Out, which is taken directly from the TD-1's input – before either the tube or solid state impedance buffers, so plugging into this output may impact input impedance. Finally, we have a dedicated 1/4" mono Phones Out, which has been optimized for use with Sennheiser model HD-600 headphones. Output level to the Phones Out is provided via a "20-turn" potentiometer. The beauty of having all of these outputs is that they all function simultaneously, so the output connection possibilities are endless (or close enough to it). The HV-3 Mic In seems innocent enough, and is practically hidden on the back panel, but this is a world-class mic pre, and a major feature of the TD-1.

STT-1 Origin

The STT-1 Origin is a no-holds-barred, full-size 2U recording channel. "Feature-rich" doesn't begin to describe the STT-1. Let's check out the front panel. Beginning at the top left corner, we have the switch for selecting the vacuum tube (VT) or solid state (SS) front-end gain stage, followed by the phantom power and polarity reverse switch. Then we get to the "XFMR IN" switch, which is an awesome feature that is especially well-suited to electric bass. Selecting this switch sends the signal through the MIT-01 audio path transformer, which provides a rich, full, pleasing, tube-like coloration. If you want your tone to be as pristine as possible, you'll want to skip this feature, but I found the impact of the MIT-01 transformer to be very musical and "exciting," and I think a lot of bass players will dig it.

A three-position knob selects between the MIC, LINE, or INST inputs. The STT-1 does not have the option of three different input impedances for the instrument input, like the TD-1, but instead, uses a fixed impedance of just over 1M ohm. The mic input has an impedance of just over 6M ohm, and the line input impedance is just over 2M ohm. The STT-1 employs a red LED for the Overload Indicator, and it begins to glow when the signal is about + 18dBu, and goes solid red at +24dBu. Separate input gain controls are provided for the tube and solid state gain stages. The tube gain control offers an 18dB range, while the solid state gain control offers a massive 40dB range. Beneath these controls is the 1/4" instrument input.

The STT-1 Origin offers four bands of parametric EQ, with the middle two bands being substantially similar to the LF and HF controls of the TD-1 (although on the Origin, they bear the labels "LM" and "HM," and the frequency ranges are slightly tweaked). The LF control on the STT-1 offers the choice of either low-frequency shelving at 6dB per octave, or else peaking, with a fixed Q of 1.0. Six frequency options are provided, 20Hz, 34Hz, 56Hz, 100Hz, 180Hz, or 270Hz. The HF control also offers the shelving/peaking option, with frequency selection options of 4.8kHz, 5.8kHz, 8.0kHz, 10kHz, 16kHz, or 21kHz. All four bands may be independently switched in or out, and a global EQ in/out switch is also provided.

In addition to offering the user the choice of either tube or solid state

front-end gain stages, the STT-1 also offers the choice Twin Topology with regard to the EQ and compressor. When the EQ/COMP TT switch is engaged, both the EQ and compressor is provided via a class-A solid state FET amplifier. When the switch is disengaged, EQ and compression is provided via vacuum tubes (also class-A). Moving on, we find a full-featured compressor, with controls for threshold, attack time, release time, and ratio control. Anyone who has experience with a stand-alone, studio-grade compressor will be right at home. In addition, the STT-1 provides the Flip Dynamics switch, which places the dynamics section either before, or after the EQ section. A De-Esser is also provided, for filtering of certain "sibilant" frequencies. This tool can be especially useful on vocals, but I couldn't hear much of a difference when using it on electric bass.

The last row of buttons includes the COMP + LIM in/out switch, the Output Mute in/out switch (which mutes all Main Outputs, but does not affect the Direct Output), and the Meter GR switch. When this switch is "on," the VU meter indicates the amount of dynamics gain reduction. When it is off, the VU meter tracks the output of the balanced main outputs (note: a meter reading of "0" is equivalent to a balanced output level of +4dBu). The Output Master control offers up to +10dB when set fully clockwise, and -16dB when turned fully counter-clockwise. The VU meter itself is big and proud, and just looks so darned cool! It's a true analog meter, and has a fine-tune control for setting the zero point.

The back panel of the STT-1 seems luxuriously spacious when compared to the TD-1, but packs plenty of options. The IEC power receptacle and main fuses are similar, but there's no power switch (it's on the front), and the STT-1 has a unique ground lift jumper, instead of the little red button on the TD-1. Like the TD-1, the STT-1 has the XLR microphone input on the back panel, but it also places and XLR and TRS 1/4" line inputs right next to the mic input. The XLR Direct Out is a balanced copy of the front-end input. Unbalanced XLR and 1/4" Main Out jacks are also provided, as is a balanced XLR Main Out. The RCA-style jack labeled Dynamics Link connects to the dynamics side chain circuit, and is used to link two STT-1 units together for stereo operation.

The Millennia Experience

There can be no doubting that the Millennia TD-1 and STT-1 Origin are top-flight, high-quality units. The feature sets speak for themselves, and may put more than a few jaws on the floor, all on their own. While lightweight bass heads are all the rage, there remains a certain expectation that the *really* high-end gear is going to have some weight. This may be an irrational bias; I can't really say. But solid chassis, big capacitors and quality transformers do add up on the weight scale, and I will admit to experiencing a certain subconscious connotation between weight and quality – especially in regard to preamps, DI's, EQ's and dynamics processors. Both the TD-1 and the STT-1 have a very satisfying – even surprising, in the case of the TD-1 – heft to them, which I love. The thick, black faceplates and sturdy, illuminated buttons add to the quality feel, but those knobs really steal the show. They are easy to get your hand on them (which, unfortunately, is not always the case with gear sporting more than a couple of knobs), and have great tactile feedback. The larger EQ boost/cut and Master Output knobs border on decadence, and facilitate the kind of fine-tuning control you'd expect in a recording studio control room.

These Millennia units pretty much tick off all the boxes that a discriminating player may be looking for in a high-end preamp/DI/recording channel. But the ultimate question is, "How do they sound?" That is not an easy question to answer, because of the incredible range of tone-shaping options provided. Consider the choice of solid state or tube front-end gain stages. The solid state FET option is characterized by a solid, full tone. The vacuum tube option definitely adds more harmonic "excitement," but remains controlled. No matter which topology route you choose to follow, the baseline tone feels very true to the instrument, and words like "uncolored" and "pristine" are both unavoidable and highly appropriate.

If you do need to tweak your tone, though, the EQ is amazing. I'm a

big fan of truly parametric EQ, and the ability to choose a more broad or narrow Q setting is very powerful. I tend to prefer a more broad setting for boosting, and a more narrow filter when cutting, but you may have an entirely different approach, and Millennia puts you in control of what their EQ can do. Frequencies which can be difficult to dial in on some bass heads/preamps (such as the upper bass to low midrange region) are a breeze to master with Millennia EQ. The extended range on the high frequency controls allows you to dial out hiss, without diminishing desired frequencies. Despite the raw power and control of the EQ, I noticed that when the global EQ is engaged, and you take the individual EQ filters in/out, there is no perceivable tone difference, provided that the boost/cut knob is set to "0." Impressive!

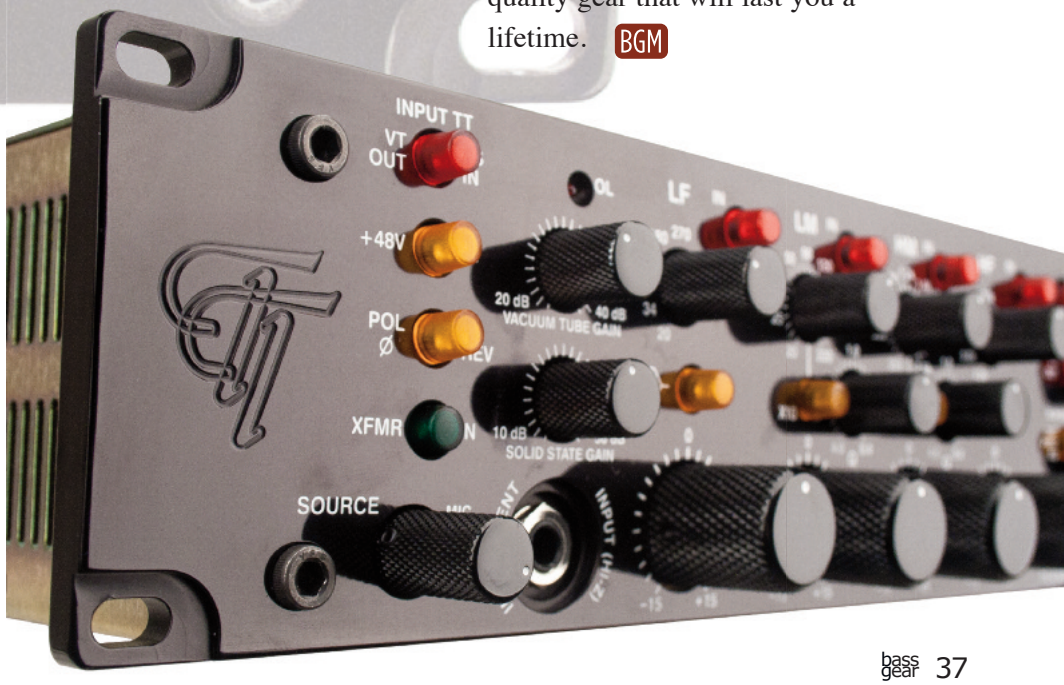
The impedance selection options on the TD-1 didn't make a big difference for me when I was using a passive Jazz Bass, but with my old Kay upright – equipped with a Barbera bridge pickup system featuring eight piezo elements – it made for some real differences. With the Kay, the 10M setting had the most full tone, the 470k setting was more thin, but well-defined, and the 2M option fell somewhere in between.

As I mentioned, the TD-1 has been my "gold standard" for several years. It is about the same size as an Avalon U5, but offers a lot more in terms of features and control. Recently, I've been quite enamored with the Jules Amps Monique tube bass preamp/DI, so a comparison had to be made. Ultimately, these two units have very different target design goals, but they each offer a compelling option to bass players who obsess over their tone. Dialing in what I felt to be a fairly well-balanced and musical bass tone on both units, Monique was more thick, warm and round, and the TD-1 was more articulate and clear. These distinctions held true in both tube and solid state topologies, but when I switched to the STT-1, engaging the transformer definitely made the STT-1 sound more "Monique-like." One of the more Spartan, but solid and true-sounding, preamps I've used for years and years is the Stewart UDP-1a. Compared to the Stewart, the TD-1 (set totally flat) had similar tone balance and overall "evenness," but the TD-1 was decidedly more "exciting." The UDP-1a does do the "un-hyped thing" very well, though.

Based upon numerous gigs with the TD-1, and time spent playing a number of instruments through both the TD-1 and STT-1 (using multiple amps and cabs), I was thoroughly impressed in each and every scenario. These units just flat-out sound great, and they give you control over important aspects of your signal path which you simply don't get with other products.

The Bottom Line

There are many paths to take in the pursuit of tonal nirvana. If you have already managed to reach that happy place, then sit back, enjoy, and play some bass! But if you aren't quite there yet, or wonder if the grass might be greener elsewhere, I strongly suggest that you check out what the Millennia TD-1 or STT-1 Origin bring to the table. These recording channels were designed to work well with a variety of sources, including bass of all kinds – electric bass guitar, acoustic bass guitar, upright bass, bass synth, etc – and they may open up tonal possibilities that you've previously been missing. This is quality gear that will last you a lifetime. BGM



bass gear test

Millennia STT-1

ENCLOSURE

Material:	16 gauge steel chasis
Dimensions:	19" W x 3.5" H x 15.5" D
Weight:	25 lbs
Rackable:	Yes

PREAMP

Inputs:	1x1/4" Instrument Input (front panel); 1xXLR Mic In (back panel); 1xXLR Line In (back panel); 1x1/4" Line In (back panel)
Mode:	Tube/Solid State
Tubes:	1x12AT7 (Instrument DI); 1x12AX7 and 1x12AU7 (Input Amplifiers); 1x12AX7 and 1x12AU7 (EQ and Dynamics Amplifiers)
Input Impedance:	>1 MegOhm
EQ Type/Features:	Low selectable between 20, 34, 56, 100, 180, 270Hz (Peak or Shelf selectable); Low Mid Parametric selectable between either 20Hz to 220Hz or 200Hz to 2.2kHz, Q0.4-4.0 sweepable, +/- 15 dB (21 step detent); Hi Mid Parametric selectable between either 250Hz to 2.5kHz or 2.5kHz to 25kHz, Q0.4-4.0 sweepable, +/- 15 dB (21 step detent); Hi selectable between 4.8, 5.8, 8.0, 10, 16, 21kHz (Peak or Shelf selectable)
Compressor/Limiter:	Optical - Threshold (range of 40 dB Continuously Adjustable); Attack (range of 2 mS to 100 mS, Continuously Adjustable); Release (range of 20 mS to 3.0 S, Continuously Adjustable); Compression Ratio (range 1.4:1 to 30:1 Continuously Adjustable)
Output:	1 x XLR Balanced Out; 1 x XLR Unbalanced Out; 1 x 1/4" Unbalanced Out; 1xXLR Direct Out
Effects Loop:	No
Dedicated Tuner Out:	No
Construction:	PCB
Additional Features:	Switch to select between Tube and Solid State; 48V Phantom power;Polarity Reverse switch;Transformer In/Out Switch; EQ Bypass Switch; Each EQ Band Independently Bypassable; Switch to select between Tube and Solid State for EQ and Dynamics stages; Switch to place Dynamics either Post EQ or Pre-EQ

POWER AMP

Mode:	N/A
Tubes:	N/A
Outputs:	N/A
Impedance Options:	*N/A*
Power Supply/Transformer:	Analog
Cooling System:	N/A
Line Voltage Options:	100VAC to 240VAC, 50/60Hz, selectable

GENERAL

Company:	Millennia Music & Media Systems 4600 Missouri Flat Road Placerville, CA 95667 www.mil-media.com
Country of origin:	USA
Year of origin:	2012
Warranty:	1-year
List price:	$3,409.00
Street price:	$3,067.99
Price as tested:	$3,067.99
Options:	None
Accessories:	None
Available colors:	Black/Platinum
Acquired from:	Millennia Music & Media Systems
Dates:	February-April 2013
Locales:	Ohio
Test gear:	Bergantino HD212, fEARful 15/6/1, AudioKinesis TC115AF, Crest CA9, GK MB Fusion, Markbass Big Bang, '40s Kay upright with Barbera bridge, Sadowsky P/J 5, Squire by Fender '62 Jazz Reissue, Blast Cult One4Five, Jules Amps Monique, Stewart UDP-1a

TEST RESULTS

1-5 (unacceptable to impeccable)

In-Hand		On-Bench	
Features:	5	**Internal Parts**	4.75
Tonal Flexibility:	5	**External Parts**	4.50
Ease of Use:	3.5	**Overall Assembly**	4.50
Aesthetics:	4	**Ease of Repair**	3.50
Tone:	5	**Instructions/Manual**	4.00
Value:	3	**Quality Per Price**	4.00

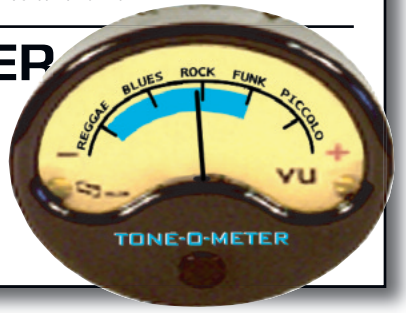
In-Hand Score
4.25 average

On-Bench Score
4.21 average

SONIC PROFILE:
Lows: Full, tight, controlled
Mids: Huge range of midrange tones available
Highs: Tons of control available; very musical and rich

TONE-O-METER

Much like the TD-1, the STT-1 can cover a huge range of tones. Once again, the baseline tone is uncolored, well-balanced, pure and musical. Transformer option makes it more "tube amp like."



Tom Lees'
AMP LAB

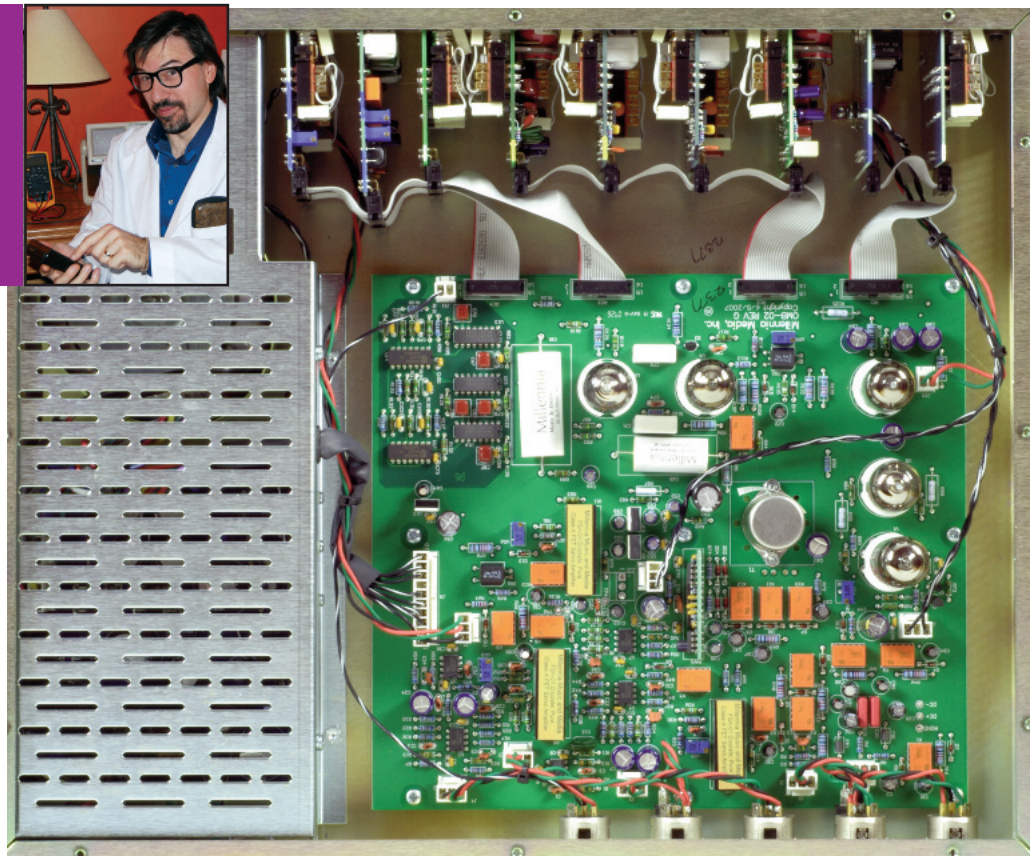


Fig. 1 Gut shot, STT-1

Millennia STT-1

Okay, I will admit a small addiction of mine. I have been phasing out my CD collection in favor of songs loaded into my iTunes® library. Because I respect the artists that create this music... and our copyright laws… I purchase all of my music (as you should, too). However, I cannot afford to purchase every album by every artist that I want. So, I have become addicted to the "greatest hits" album purchases. Yup. *Journey*, Tom Petty, *Eagles*, Bruce Springsteen up to the *Foo Fighters*, the greatest hits define the playlists of my iTunes library. So, when offered a chance to take a look at the Millennia STT-1, I could not pass it up. The STT-1 Origin represents input stage circuitry, equalization, compression and de-

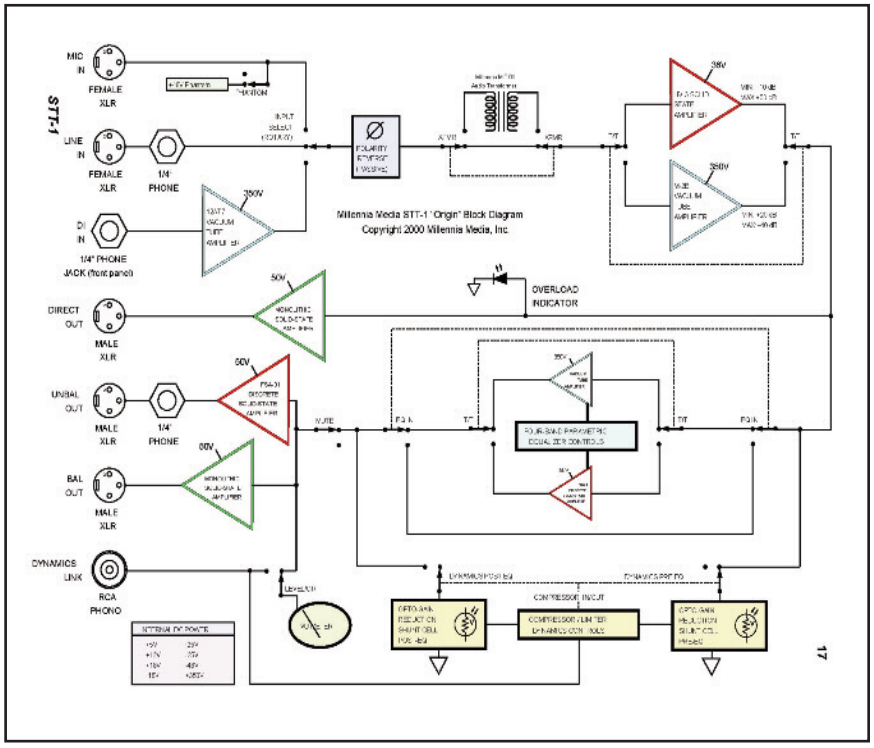


FIG. 2 SST-1 Block diagram

essing from Millennia's very best designs, thus presenting a Millennia "greatest hits" of processing.

We always kick things off with a gratuitous "gut shot," which is illustrated as *Fig. 1*. Here, the STT-1 does not disappoint. The power supply is neatly tucked off to one side and is enclosed in a ventilated enclosure. A main circuit board hosts five vacuum tubes (a mix of JJ brand 12AX7 and 12AT7 tubes), large custom-branded capacitors (the white tubes with the Millennia label), discrete class-A FET servo amplifiers (those large yellow rectangles), a daughter circuit card that extends vertically from the center of the main circuit board, as well as various integrated circuits and discrete components. A series of vertical circuit cards host circuitry that couple the user controls on the front panel to the main circuit board using ribbon cable. Panel-mounted output connectors couple to the main circuit board via Molex connectors.

Understanding the STT-1 Origin

Refering to *Fig. 2*, the STT-1 provides a single-channel input that is selectable by a control on the front panel that selects among three inputs, including a Mic input, a Line input and an Instrument DI input. The Instrument DI input is processed by a dedicated tube circuit based around a 12AT7 vacuum tube positioned before the input selector. The Mic input and Line input are passed directly to the input selector.

The selected input source is passed through a polarity reversal circuit to a bypassable transformer stage. The transformer stage passes the signal through a custom Millennia transformer providing electrical isolation to the signal. Moreover, at higher signal levels, the sonic character of the transformer can be used to apply "color" to the input.

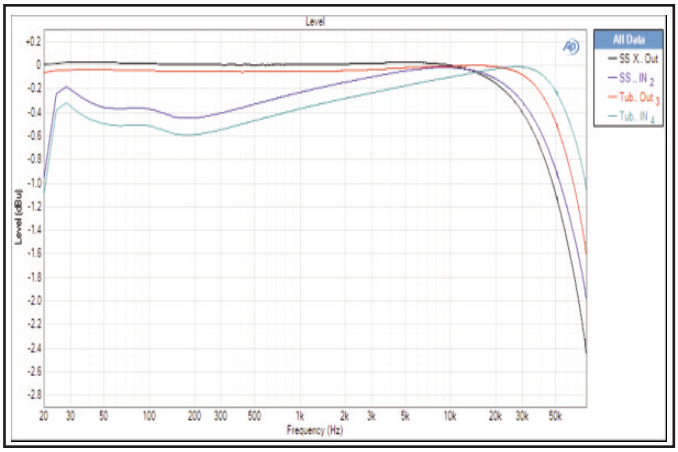


FIG. 3 EQ and Compression bypassed

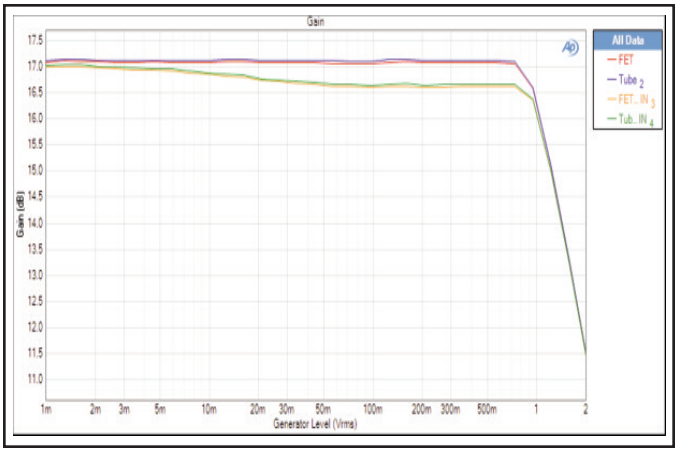


FIG. 4 Gain comparison solid state and tube with and without transformer

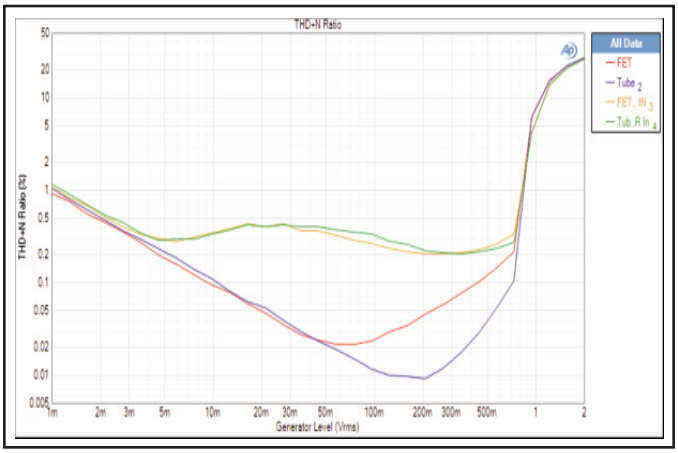


FIG. 5 THD+N ratio vs measured level

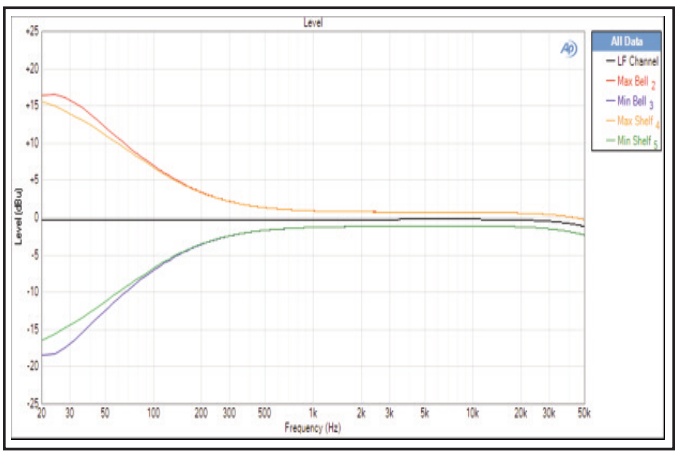


FIG. 6 Low band

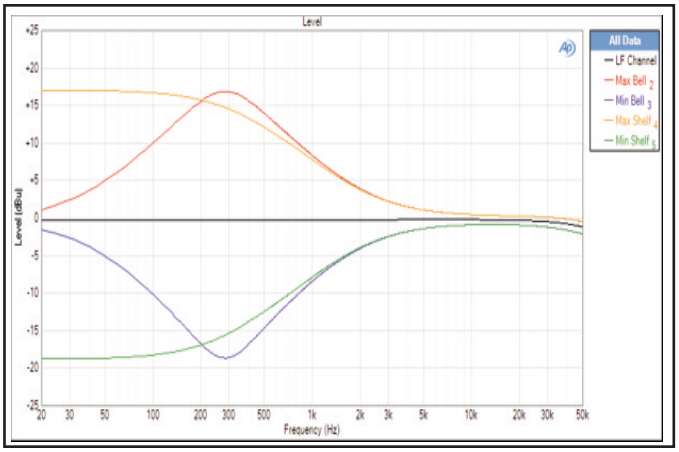


FIG. 7 Low band

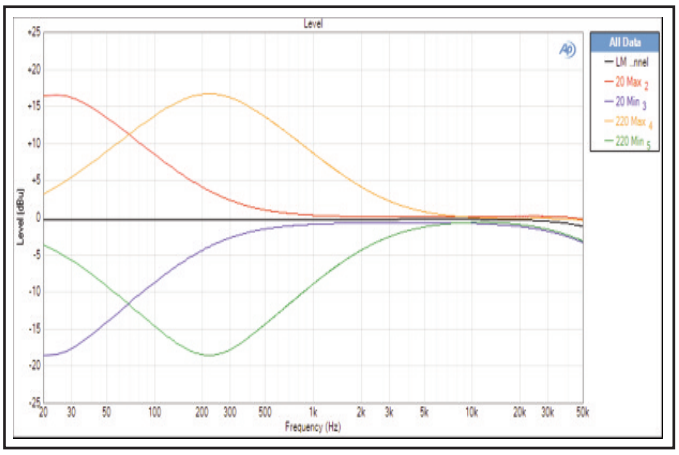


FIG. 8 Low-mid band

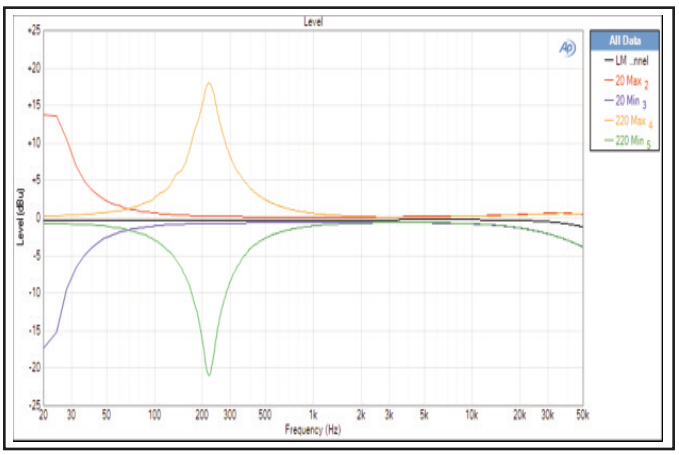


FIG. 9 Low-mid band

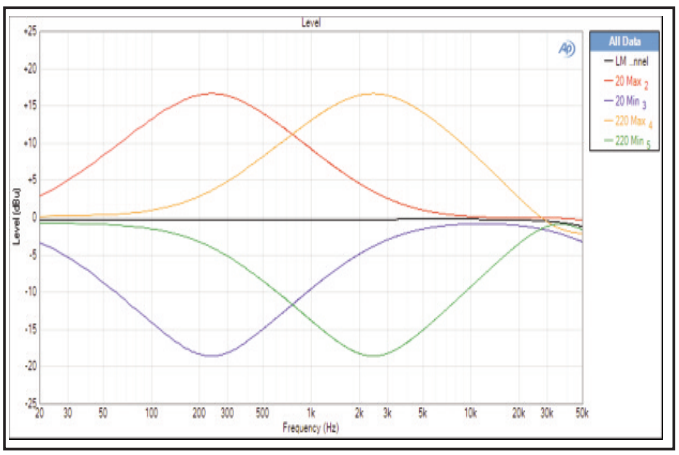


FIG. 10 Low-mid band

It is not new to the bass community to see bass amps with a choice of either tube or solid state stages. However, the STT-1 takes this concept a step further. The user has the option to select a tube or solid state input stage independent of a tube or solid state equalization stage. In this regard, solid state and tube topologies, with or without transformer coupling, can be mixed and matched as desired.

More particularly, the signal couples from the bypassable transformer stage to a switch that selects either a solid state input stage or a vacuum tube input stage. The solid state and tube circuits each have independent input gain trim controls. The signal from the user-selected input stage flows through a solid state amplifier to a Direct Out. The signal from the user-selected input amplifier also couples to a bypassable equalization stage.

Within the equalization stage, a four-band parametric equalizer is provided, which is driven by a user-selected solid state amplifier or a tube amplifier. A dynamics stage, including a compressor and de-esser, can share the same selected amplifier (solid state or tube) as used by the equalizer stage. The dynamics stage can alternatively function without using the selected amplifier of the equalizer stage. Moreover, a control on the front panel is provided to place the dynamics stage either before or after the equalizer stage. The compressor uses an optical gain reduction shunt cell to control compression, which can be fed from a signal taken either pre-equalizer stage or post-equalizer stage. The output of the equalization and dynamics stages passes through a final amplifier to the outputs, which provide unbalanced and balanced outputs, and which are simultaneously available.

As such, the user can select for instance, an entirely discrete, entirely class-A direct signal path from

input to output. The user can alternatively select to inject tube processing into the signal path at the input stage, equalization stage, or both. The user can also select transformer or non-transformer coupling. All-in-all, a mind-boggling number of combinations are available with a somewhat deceivingly simple set of controls.

Analysis

Referring to *Fig. 3*, my tests began by evaluating the input stages. The input gain trim controls of the solid state and tube stages are intentionally not level/position matched. As such, to get equivalent gains, I set the trim of the solid state amplifier fully counterclockwise, and set the tube gain control to about 11:00, which is were I found the signals to be fairly well-matched in output level. I then ran frequency response plots out to 50kHz for solid state (with and without transformer) and tube (with and without transformer). I measured a slightly extended frequency response from the tube stage, compared to the solid stage with no transformer (compare the black trace – solid state, to the red trace – tube). The transformer imparted the greatest exaggeration on the tube stage (compare the blue trace – solid state with transformer engaged, compared to the green trace – tube with transformer engaged).

The stronger the signal level, the more the sonic characteristics of the transformer are evident. For instance, referring to *Fig. 4* and *Fig. 5*, the traces are as follows: solid state (red), tube (blue), solid state with transformer in (orange), and tube with transformer in (green).

Fig. 4 illustrates a plot of gain as a function of input level. At the particular test settings, gain began a steady drop for input signals over 1 Vrms. However, there is a gradual but measurable decrease in gain of

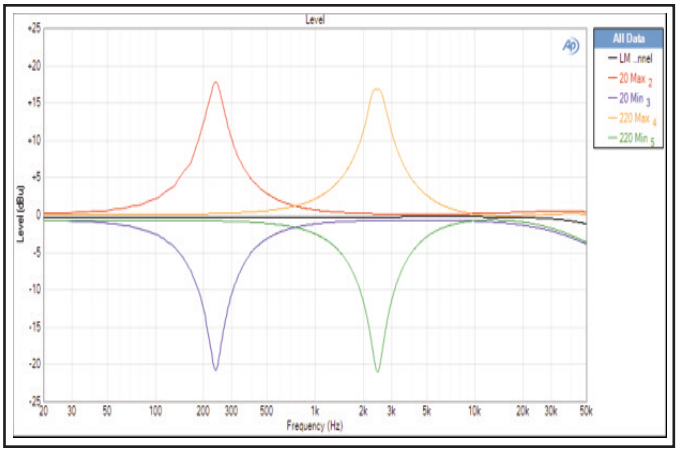


FIG. 11 Low-mid band

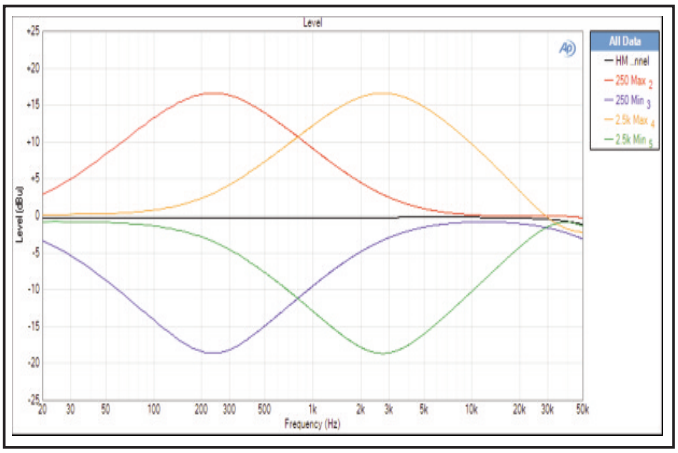


FIG. 12 High-mid band

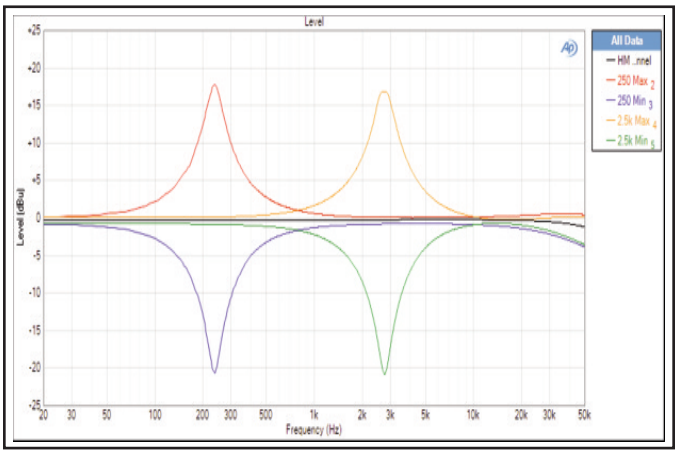


FIG. 13 High-mid band

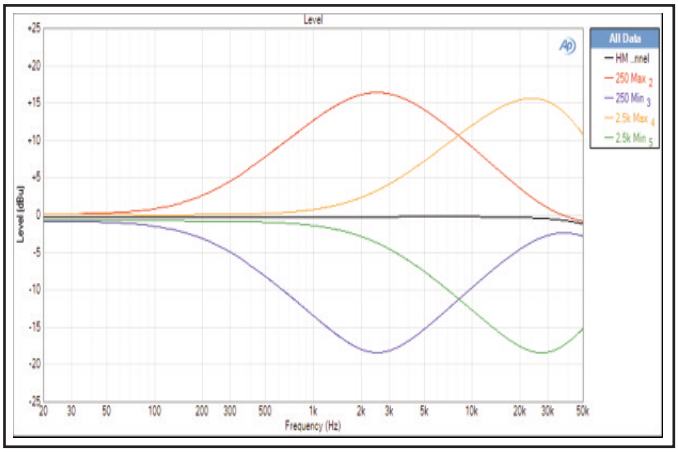


FIG. 14 High-mid band

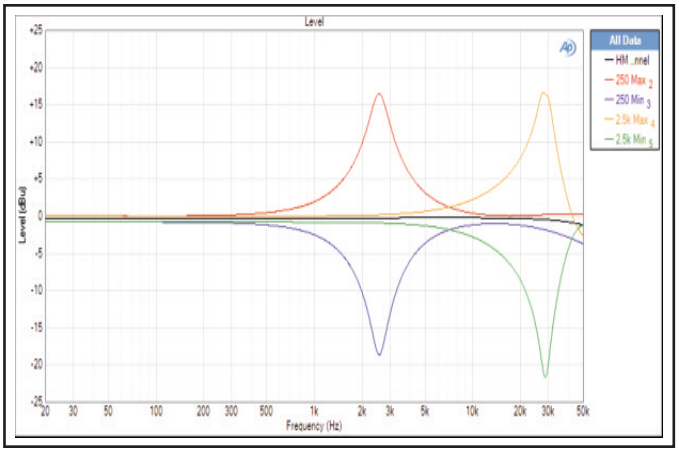


FIG. 15 High-mid band

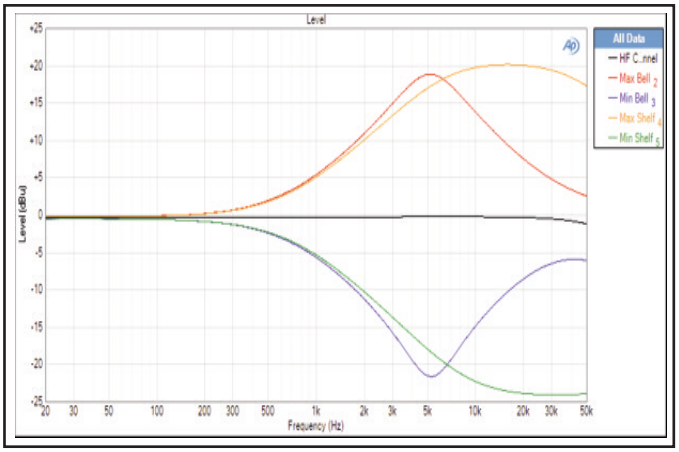


FIG. 16 High band

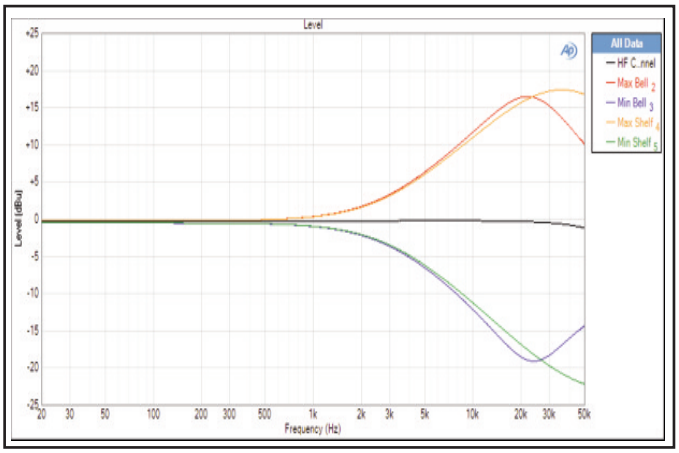


FIG. 17 High band

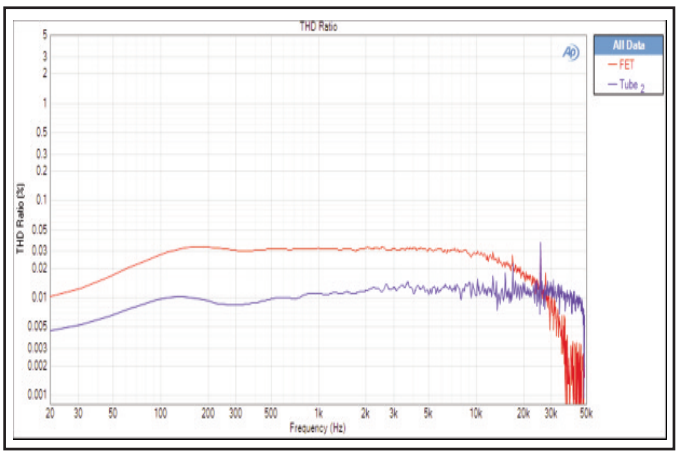


FIG. 18 THD ratio solid state vs tube EQ in

about 0.5dB as the input signal level increased towards 1 Vrms with the transformer engaged, whereas the signal remained ruler-flat up to about 700 mVrms with the transformer bypassed. *Fig. 5* illustrates that with the transformer in, as the input level increased in my test, the total harmonic distortion (THD+N) remained above 0.2% across the entire input sweep. Comparatively, bypassing the transformer allowed the distortion to drop as low as 0.01% for the tube stage. This demonstrates that the transformer is not "gimmicky," but rather provides a way to impart sonic "color" to the input as the user sees fit.

The Equalizer

Before getting into the discussion of the equalizer, it is worthwhile addressing a few simple concepts. A parametric equalizer provides adjustability of three filter parameters, including gain (amplification or attenuation), center frequency, and bandwidth of the gain. Depending upon the architecture and design, the three filter parameters may be interactive or they may be independent.

However, it really is not convenient to talk about bandwidth of an equalizer band. Keep in mind that we hear with logarithmic frequency sensitivity. Thus, bandwidths at higher frequencies would have to be larger to provide the basic same audible effect as an equivalent bandwidth at a lower frequency. To compensate for this, we describe bandwidth as a parameter referred to a quality factor, or simply Q. Q is the center frequency divided by bandwidth. This formula normalizes bandwidth so that we can discuss the "shape" of the cut or boost independent of the center frequency. In this regard, the smaller the value of Q, the larger (wider) the frequencies affected by the band. Likewise, the larger the value of Q, the smaller (more narrow) the frequencies affected by the band.

The STT-1 boasts independent bands that can be individually added to the circuit or bypassed from the circuit using individual switches on the front panel. Additionally, the STT-1 boasts independent, highly uncoupled controls, allowing consistent and absolute control of the applied equalization, with a Q adjustment that varies from 4.0 to 0.4 in each of the low-mid and high-mid bands. Moreover, regardless of whether tube or solid state, the equalizer stage places a single amplifier in the signal path. Each band is built into a shunt network about this single amplifier, such that a band, even if actively connected to the circuit via the front panel switch, only affects the signal if the gain control is set to a value other than 0 (center position).

Taking a look at the equalizer, there are way too many options to discuss in a single review. Thus, this discussion only highlights certain features of the equalizer. In addition to the selection between solid state or tube gain for the equalizer stage, the user can select up to four bands, each individually selectable. The bands include a low low-mid, high-mid and high bands.

The low band allows an extremely flexible treatment of low end. The user can select between shelving or bell, +/-15dB at a center that is user-selectable at one of 20Hz, 34Hz, 56Hz, 100Hz, 180Hz, or 270Hz. Referring to *Figs. 6* and *7*, the low band is illustrated at the extremes of 20Hz and 270Hz in both shelf and bell modes.

The low-mid band offers parametric bell filtering from 20Hz to 220Hz at a quality factor (Q) from 4 to 0.4 at +/- 15dB. The low-mid band also includes a x10 switch that shifts the frequency up by a factor of 10 to allow adjustment between 200Hz and 2.2kHz. Referring to *Figs. 8 - 11*, equalizer plots are provided for the extreme frequency and Q settings.

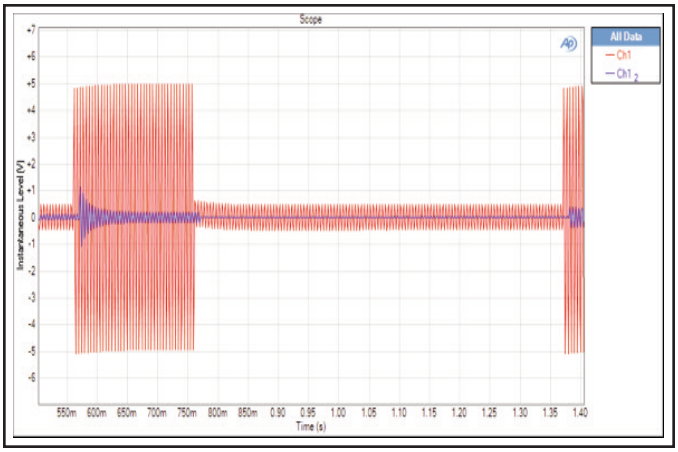


FIG. 19 Scope threshold -20

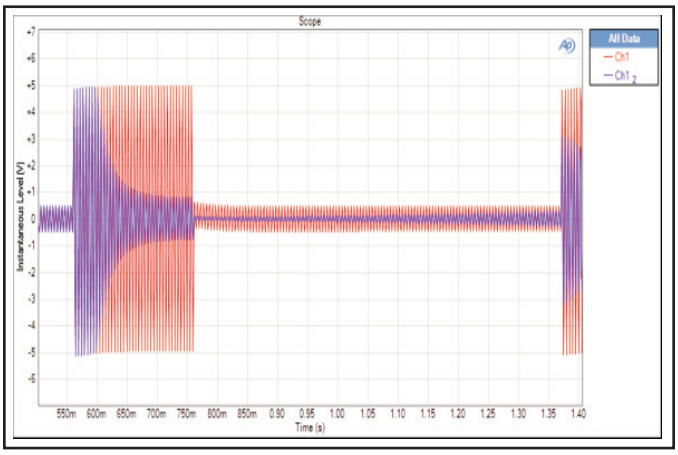


FIG. 20 Scope threshold noon

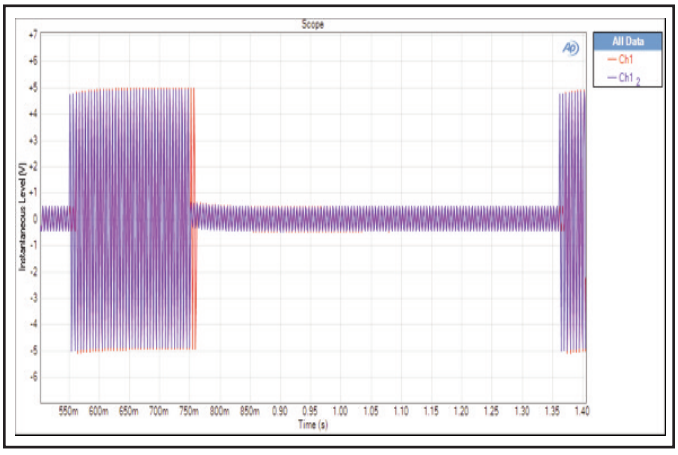


FIG. 21 Scope threshold 20

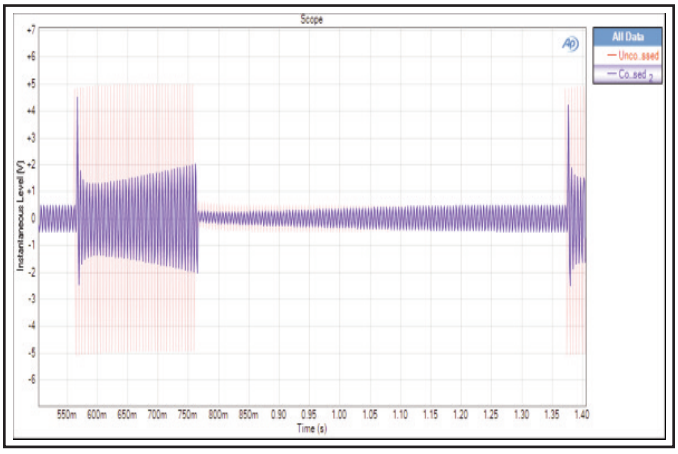


FIG. 22 Scope attack 2 ms

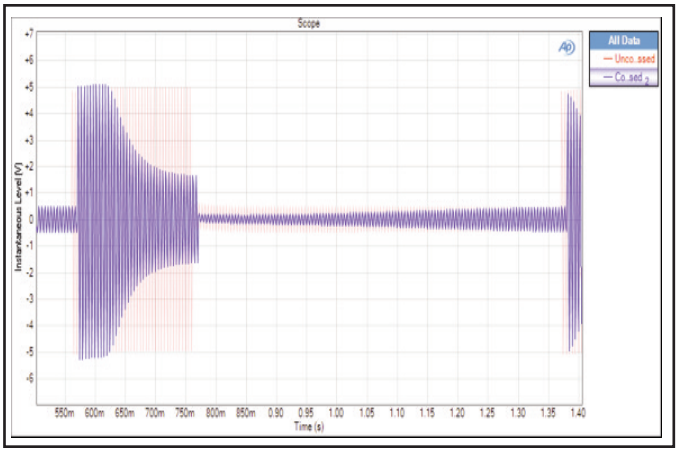


FIG. 23 Scope attack at noon

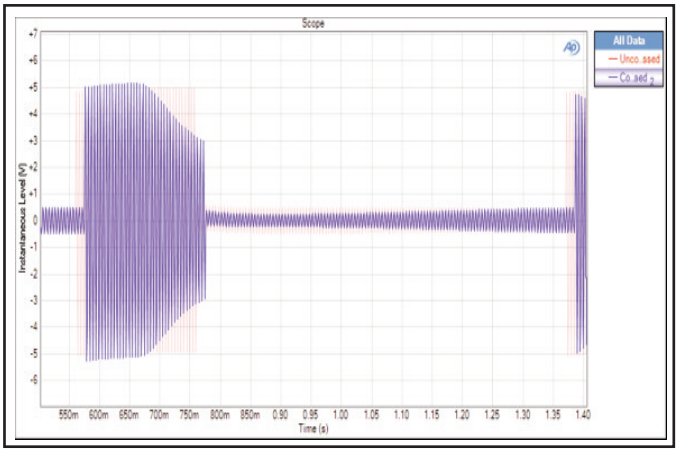


FIG. 24 Scope attack 100 ms

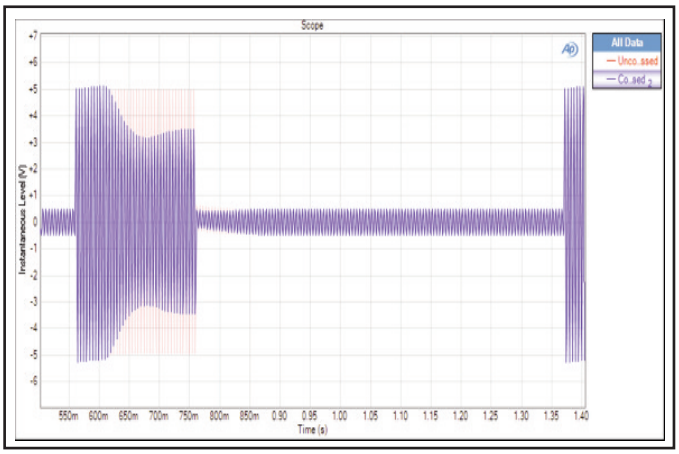


FIG. 25 Scope release 0.02

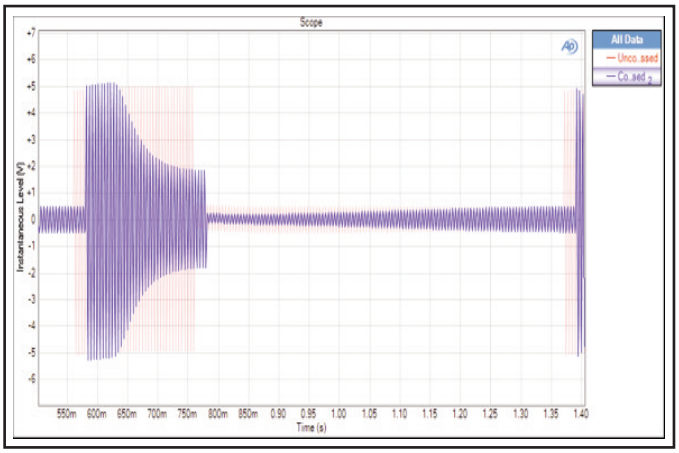


FIG. 26 Scope release 1

The high-mid band offers parametric bell filtering from 250Hz to 2.5kHz at a quality factor (Q) from 4 to 0.4 at +/- 15dB. The high-mid band also includes a x10 switch that shifts the frequency up by a factor of 10 to allow adjustment between 2.5kHz and 25kHz. Referring to *Figs. 12 - 15*, equalizer plots are provided for the extreme frequency and Q settings.

The high band allows an extremely flexible treatment of high end. The user can select between shelving or bell, +/- 15dB at a center that is user-selectable at one of 4.8kHz, 5.8kHz, 8kHz, 10kHz, 16kHz, or 21kHz. Referring to *Figs. 16* and *17*, the high band is illustrated at the extremes of 4.8kHz and 21kHz in both shelf and bell modes.

The behavior of the equalizer stage is the same, regardless of whether the tube or solid state amplifier is used. However, the character of the signal changes depending upon which amplifier is used. Referring to *Fig. 18*, the tube amplifier exhibits relatively lower distortion when toggling the tube/solid state equalizer switch. This could be attributable to the fact that Millennia intentionally does not level-match between tube and solid state.

Compressor/De-Esser

The compressor provides control over the threshold, attack time, release time and compression ratio. The threshold defines a point where signals below the threshold are unaffected. Thus, signals that exceed the threshold are treated by the compressor. The attack is how “fast” the compressor acts to clamp the signal. The faster the attack, the faster the clamping action. Likewise, the release determines how long after the signal falls below the threshold the compressor stops working. The ratio is how much gain reduction is applied. For instance, a ratio of 2:1 means that for every 2dB the input increases

above the threshold, the output only increases by 1dB. It can be difficult to describe the behavior of a compressor, so I thought I would simply show it.

For these tests, I engaged the compressor, turned off each equalizer band individually and set all four compressor controls to the center (noon) position. I then picked one control at a time and swept that control, leaving the others at their center positions. I injected a test signal that included bursts of signal level with enough cycles to illustrate the parameters of the compressor. *Figs. 19 - 21* illustrate the threshold swept from fully counterclockwise, noon and fully clockwise, with all other controls at noon. *Figs. 22 - 24* illustrate the attack swept from fully counterclockwise, noon and fully clockwise, with all other controls at noon. *Figs. 25 - 27* illustrate the release swept from fully counterclockwise, noon and fully clockwise, with all other controls at noon. *Figs. 28 - 30* illustrate the ratio swept from fully counterclockwise, noon and fully clockwise, with all other controls at noon.

The de-esser uses the same --resistive gain reduction elements used by the compressor, and can be used simultaneously with the parametric equalizer. The de-esser and broadband compressor/limiter cannot be used simultaneously. The de-esser can be varied from off, 4.9kHz, 6.8kHz, 8.2kHz, 10.7Hz or 12kHz. The de-esser is interactive with the compressor controls, so there is a significant amount of flexibility. Referring to *Fig. 31*, the de-esser is illustrated sweeping the frequency control. *Fig. 32* illustrates the effect of setting the de-esser frequency and varying the compressor threshold to affect the amount of cut.

Conclusion

One of my favorite things about "greatest hits" compilations is that there is no filler stuff. True to

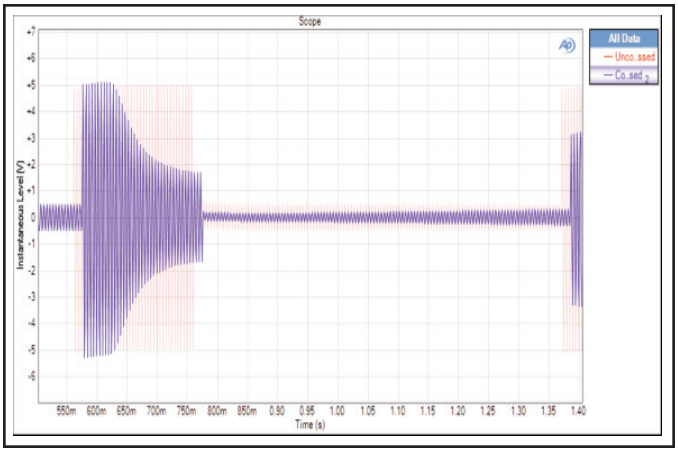


FIG. 27 Scope release 3

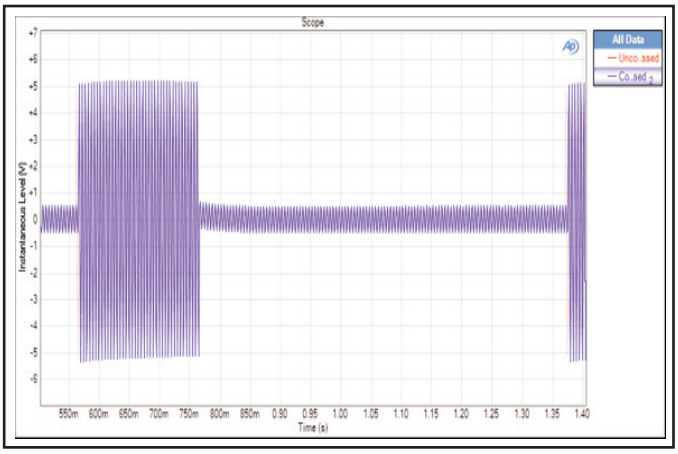


FIG. 28 Scope ratio 1.4 to 1

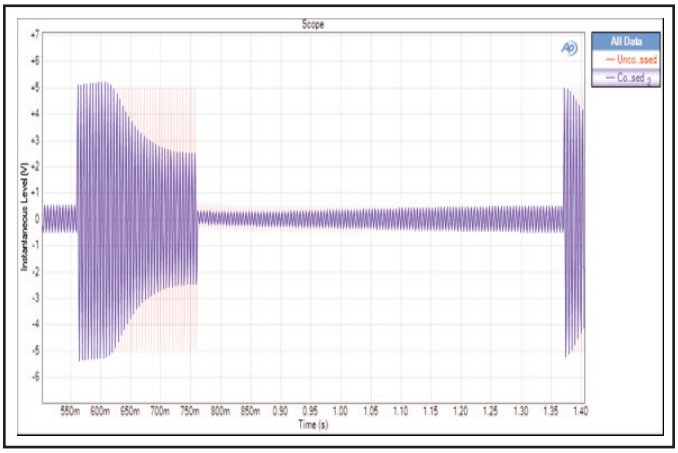


FIG. 29 Scope ratio 6 to 1

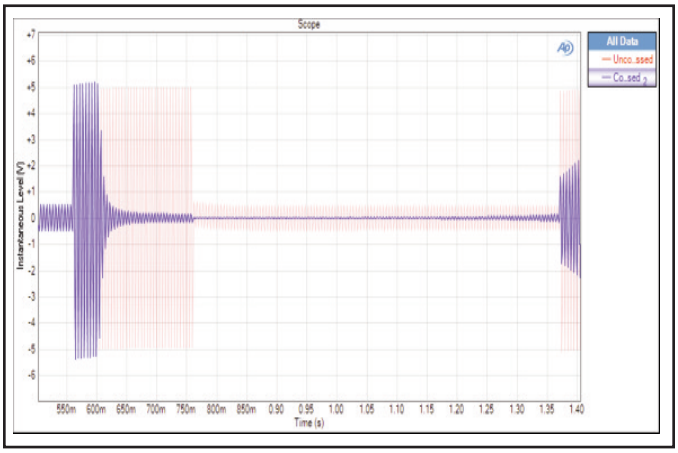


FIG. 30 Scope ratio 30 to 1

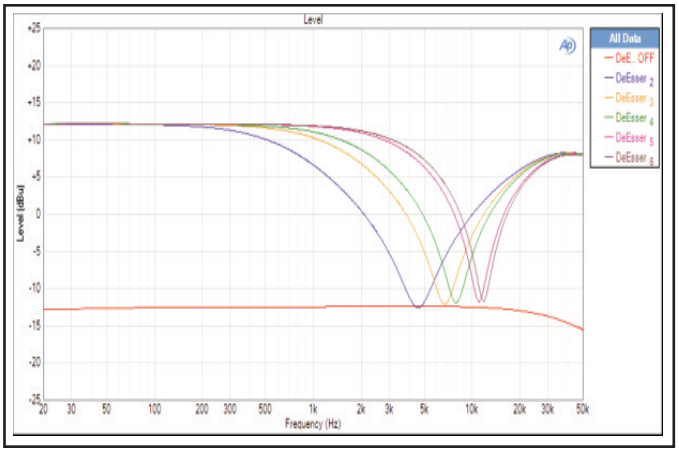


FIG. 31 De-esser sweep

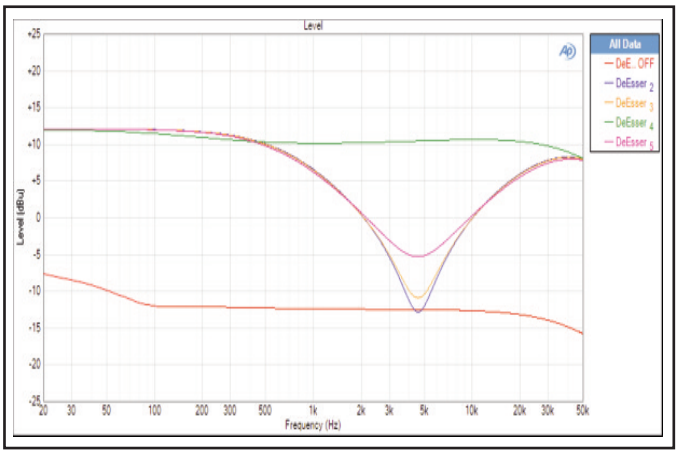


FIG. 32 Vary compressor threshold

this concept, the STT-1 is packed full of useful, features. The equalization section is likely the most well-behaved, close to ideal implementations that I have tested. The compressor is precise and well-tuned. Again, likely the most well-behaved and precise compressor that I have tested. My only complaint about this device is that I have to let it go. I must send it along to our Editor-in-Chief for his in-hand review. BGM

bass gear MAGAZINE

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bass gear test

Millennia TD-1

ENCLOSURE

Material:	16 gauge steel chasis
Dimensions:	8.5" W x 3.5" H x 13" D
Weight:	16 lbs
Rackable:	No

PREAMP

Inputs:	1x1/4" Instrument Input (front panel); 1xXLR Line/Reamp (front panel); 1xXLR Mic In (back panel)
Mode:	Tube/Solid State
Tubes:	1 x 12AT7
Input Impedance:	User selectable between 10 Megohm; 2 Megohm and 470 kOhm
EQ Type/Features:	Low Mid Parametric selectable between either 20Hz to 220Hz or 200Hz to 2.2kHz, Q0.4-4.0 sweepable, +/- 15 dB (21 step detent); Hi Mid Parametric selectable between either 250Hz to 2.5kHz or 2.5kHz to 25kHz, Q0.4-4.0 sweepable, +/- 15 dB (21 step detent);
Compressor/Limiter:	N/A
Output:	1 x XLR Balanced Out; 1x 1/4" Balanced Output; 1 x XLR Unbalanced Out; 1 x 1/4" Unbalanced Out; 2 x 1/4" Reamp Outputs; 1 x1 /4" TRS Phones Out; 1 x 4 DI Out; 1 x XLR DI Out
Effects Loop:	No
Dedicated Tuner Out:	No
Construction:	PCB
Additional Features:	48 V Phantom power; Input ground lift; Polarity Reverse switch; 1/4" Input can handle speaker levels using Power Soak feature); Three user selectable Input Impedance Settings; EQ Bypass; Each EQ Band Independently Bypassable; Switch to select between Tube and Solid State; -20 dB pad; Reamp Outputs (2 different outputs with different characteristics)

POWER AMP

Mode:	N/A
Tubes:	N/A
Outputs:	N/A
Impedance Options:	*N/A*
Power Supply/Transformer:	Analog
Cooling System:	N/A
Line Voltage Options:	100VAC to 240VAC, 50/60Hz, selectable

GENERAL

Company:	Millennia Music & Media Systems 4600 Missouri Flat Road Placerville, CA 95667 www.mil-media.com
Country of origin:	USA
Year of origin:	2005
Warranty:	1-year
List price:	$2,100.00
Street price:	$1,889.99
Price as tested:	$1,889.99
Options:	Top handle
Accessories:	Custom gig bag ($100)
Available colors:	Black/Platinum
Acquired from:	Tom Bowlus
Dates:	February-April 2013
Locales:	Ohio
Test gear:	Bergantino HD212, fEARful 15/6/1, AudioKinesis TC115AF, Crest CA9, GK MB Fusion, Markbass Big Bang, '40s Kay upright with Barbera bridge, Sadowsky P/J 5, Squire by Fender '62 Jazz Reissue, Blast Cult One4Five, Jules Amps Monique, Stewart UDP-1a

TEST RESULTS

1-5 (unacceptable to impeccable)

In-Hand

Features:	5
Tonal Flexibility:	4.5
Ease of Use:	4
Aesthetics:	4
Tone:	5
Value:	3.5

On-Bench

Internal Parts	4.50
External Parts	4.50
Overall Assembly	4.50
Ease of Repair	3.50
Instructions/Manual	4.50
Quality Per Price	4.00

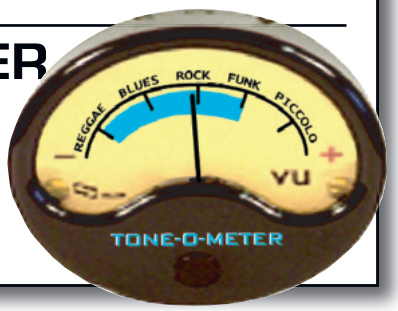
In-Hand Score
4.33 average

On-Bench Score
4.25 average

SONIC PROFILE:
Lows: Full, tight, controlled
Mids: Huge range of midrange tones available
Highs: Tons of control available; very musical and rich

TONE-O-METER

It is very hard to describe the tone of the TD-1, because it can cover such a wide range of tones. The baseline tone, however, is uncolored, well-balanced, pure and musical.



Tom Lees'
AMP LAB

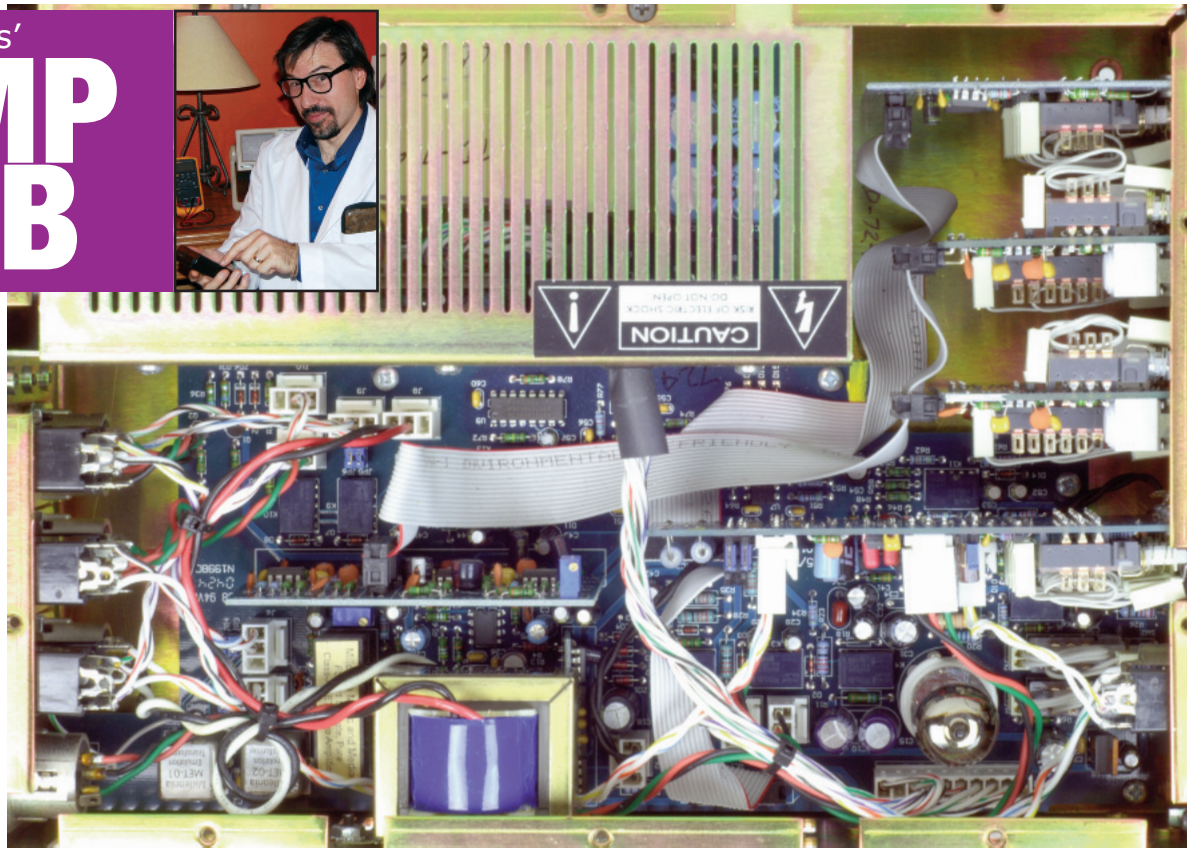


Fig. 1 Gut shot, STT-1

Millennia TD-1

I will bet that most of you out there have more than one bass, more than one amp, an extra set of cables, and a host of other accessories. However, when it comes to recording, we simply rely upon the studio to furnish the necessary equipment. When we show up at a gig, we either settle for the DI built into the amp, or rely on the soundman to use "whatever" DI he has laying around. Why is that? As much time as we spend obsessing over the tone that we hear when performing, why do we not better plan for the tone *everyone else* hears, be it in the house system or recorded at a studio? Better yet, once we are in the studio and our "sound" is printed into digital media, why do we not take every measure to carefully recreate *that* sound live? Worry not folks, because Millennia has brought us the TD-1. It is boasted as a "Twin Direct" recording channel. But we will see that it really is much more than that.

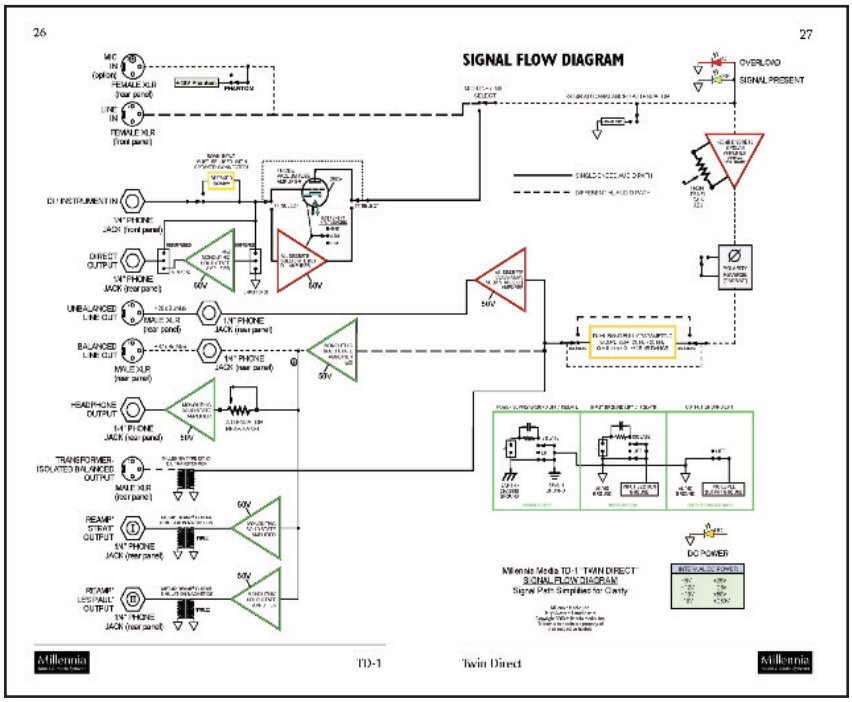


FIG. 2 TD-1 Block diagram

Referring to *Fig. 1*, our "gut shot" illustrates that the TD-1 crams about as much circuitry as possible inside its shoebox chassis. The power

supply is neatly tucked off to one side and is enclosed in a ventilated enclosure. A main circuit board hosts a single 12AT7 vacuum tube, a discrete class-A FET servo amplifier (large yellow rectangle tucked under the wires, just to the right of the transformer with the blue ribbon), a daughter circuit card that extends vertically from the main circuit board, as well as various integrated circuits and discrete components. A series of vertical circuit cards host circuitry that couple the user controls on the front panel to the main circuit board using ribbon cable. Panel-mounted output connectors couple to the main circuit board via Molex connectors.

Understanding the TD-1

Refering to *Fig. 2*, The TD-1 provides three inputs, including a Mic input (located on the back panel), an Instrument/Speaker input (1/4" input jack) and an XLR Line/REAMP input. Right out of the gate, we see that this is no ordinary device. For our tests, we will focus on the Instrument DI input, as that is the input most likely to be used by a bass player, but the Mic input is a nice extra to have on hand. The Line/REAMP input is one of the key cool features of the TD-1 and will be discussed in more detail when Reamping is revisited later in this review.

From the input, the signal is optionally coupled to a Speaker Soak circuit. "A what?" you say? Why, the input of the TD-1 can accept a speaker-level signal directly from the output of a power amplifier (also connected to a speaker cabinet). Note that the TD-1 is NOT A SUBSTITUTE for a speaker cabinet. Rather, the TD-1 can be situated in parallel with a speaker cabinet. The use of the Speaker Soak is a clever way to capture a signal suitable for live use or recording, which is tapped off your amp's main output. As far as you are concerned, you are playing your bass amp with your cabinet of choice. But behind the scenes, the TD-1 steps up to capture the tone that your amp is delivering to your cabinet, thus capturing all the nuances that you put into your performance.

The signal next couples to a switch on the front panel that allows the selection of either a tube gain stage or an all-discrete solid state FET gain stage. Regardless of whether the user selects tube or solid state, the user can also select one of three input impedances, 470 kOhms, 2 Megohms, and 10 Megohms. Depending upon the input source, changing among these settings may provide

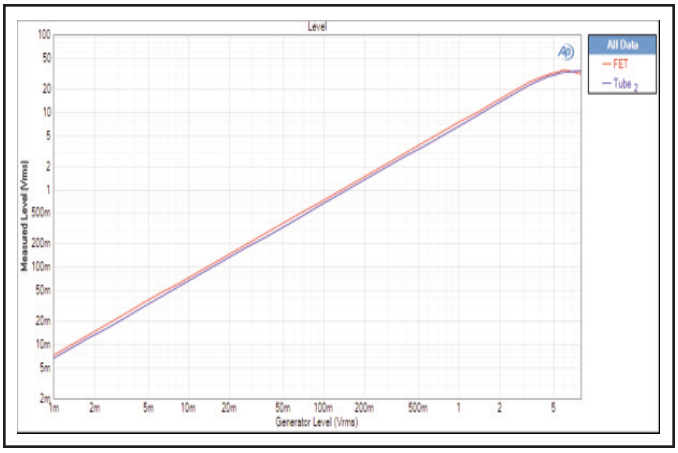


FIG. 3 250Hz sin swept level gain control at 9 o'clock

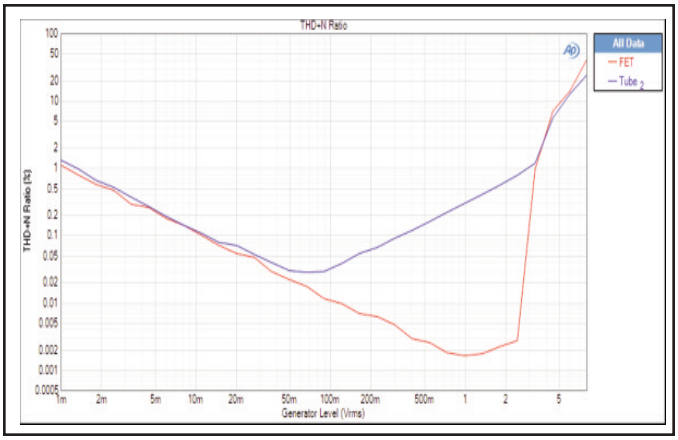


FIG. 4 250Hz sin THD+N level vs measured level

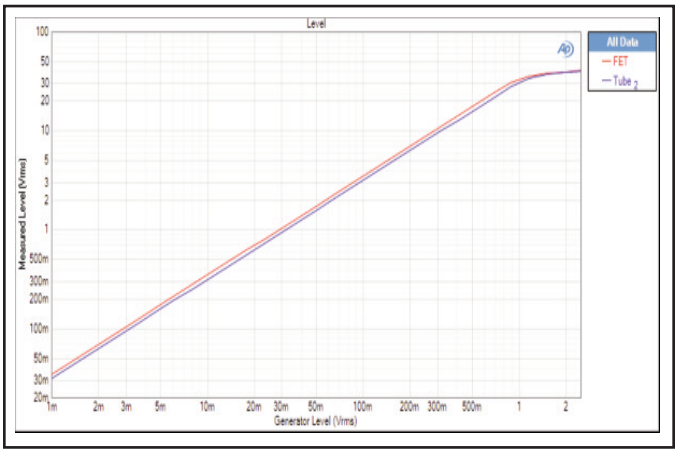


FIG. 5 250Hz sin swept level gain control at noon

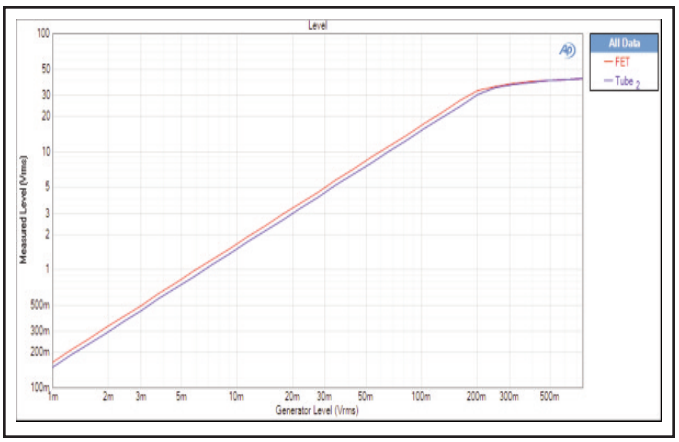


FIG. 6 250Hz sin swept level gain control max

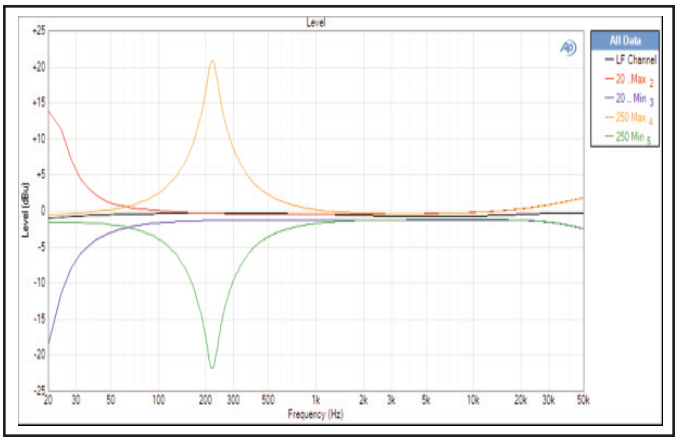


FIG. 7 Frequency sweep LF Q 0.4

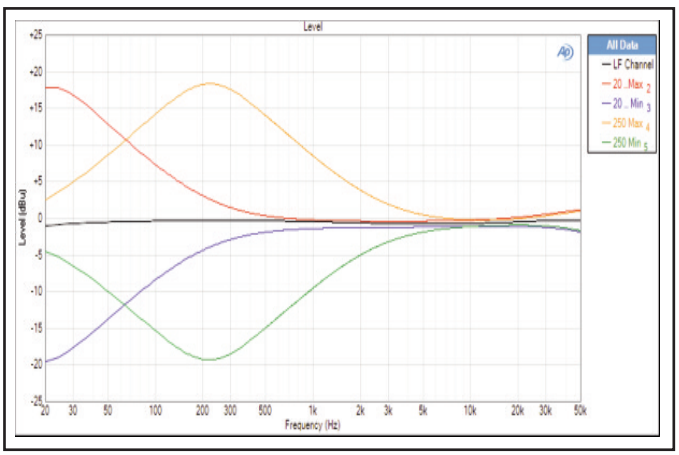


FIG. 8 Frequency sweep LF Q 4

undetectable differences, such as where the input source has an electrically buffered output with a low-output impedance (e.g., an active bass, playing through an effect pedal with a buffer, etc). However, with other sources (such as passive basses, instruments equipped with un-buffered piezo pickups, etc.), changing input impedance can have a subtle to drastic affect. Regardless of input source, you should experiment to find the input impedance that provides the most musical result.

A switch on the front panel determines whether the signal is padded by a -20dB pad. After the pad circuit, the signal passes through an amplifier with variable-gain, adjustable by a gain knob on the front panel and a polarity reversal circuit that can be bypasses by a switch on the front panel.

Next, the signal passes through a dual-band, fully programmable equalizer stage, which can be bypassed by a switch on the front panel. The programmable equalizer stage here is not your typical bass amplifier equalizer. The equalizer is precise, extremely well-behaved and predicable, with minimal band interaction.

The output of the equalizer stage passes to an unbalanced output, a balanced output, a headphone output, a transformer-isolated balanced output, a first REAMP output and a second REAMP output.

To tag back around to the input, it is worth explaining the REAMP capability of the TD-1 a bit further. The idea is this: a recorder sends a line-level signal to the Line/ REAMP input of the TD-1. The REAMP input couples to a discrete solid state amplifier with an impedance matched for playback of recorded bass tracks. In simple terms, the Line/ REAMP input presents a load that the recorder is "expecting" to see, thus coupling the output of the recorder in a precise manner. The TD-1 then uses its internal circuitry to present a signal at the REAMP 1 and REAMP 2 outputs. The first and second REAMP outputs provide a dual purpose. First, the REAMP 1 and REAMP 2 outputs shift the signal to instrument levels. Moreover, each of the REAMP 1 and REAMP 2 outputs provides distinct electrical characteristics that can be thought of as simulating an instrument, so that your amplifier is "tricked" into thinking you are plugging straight in with no effects, processors or other circuitry intervening between the instrument and amplifier. That is, when the amplifier "looks out," it thinks it "sees" an

instrument plugged directly in. Thus, the TD-1 outputs an instrument-level signal from the REAMP 1 and REAMP 2 outputs that "look" to an amplifier like they came from an actual instrument.

In a typical application, you can record your bass signal directly into the recording system, then play the raw track back through the REAMP input and REAMP output to any amplifier of choice as many times as desired, so that the recorded signal can be processed with different equalizer settings, amps, speaker cabinets, etc. Alternatively, the Line/ REAMP input can be used in conjunction with the normal balanced or unbalanced outputs.

Analysis

A switch on the front panel selects the amplifier topology used to buffer the Instrument input between an all-discrete, solid state J-FET (field-effect transistor) DI buffer amplifier or a high-voltage twin-triode vacuum tube (12AT7) DI buffer amplifier. The selectable solid state or tube gain stage is not available for the Mic or Line inputs. Rather, the Mic and Line inputs are routed directly to a discrete-hybrid solid-state amplifier.

The input of the TD-1 can handle an uncanny range of signals. Referring to *Figs. 3-8*, I swept the level of a 250Hz sine signal with the solid state stage (red) and tube stage (blue). As *Fig. 3* illustrates, the gain is steady and linearly tracks the input level for input levels up to about 5 Vrms with the gain control set to about 9:00. After about 5 Vrms, the gain drops, indicating that the signal is beginning to distort. This was with the pad disengaged! It is worth observing that for this test, the output (taken from the balanced output) was about 30 Vrms, so any question about headroom should be laid to rest.

Referring to *Fig. 4*, for that same 250Hz signal, I also looked at the distortion (THD+N) as a function of input level for both the solid state (red) and tube (blue). Note that the distortion in the solid state signal steadily declines as the input signal level increases to about 1 Vrms. Indeed, the distortion drops remarkably to below 0.002%. The tube stage stays well under 1%, but the distortion begins to increase above about 100 mVrms, illustrating the soft tube compression that is characteristic of tubes. Both the tube and solid state channels converge at about 1% THD+N. This chart is deceiving. I would not call the tube stage a "dirty" amplifier. To the contrary, for the tube amplifier, distortion remains

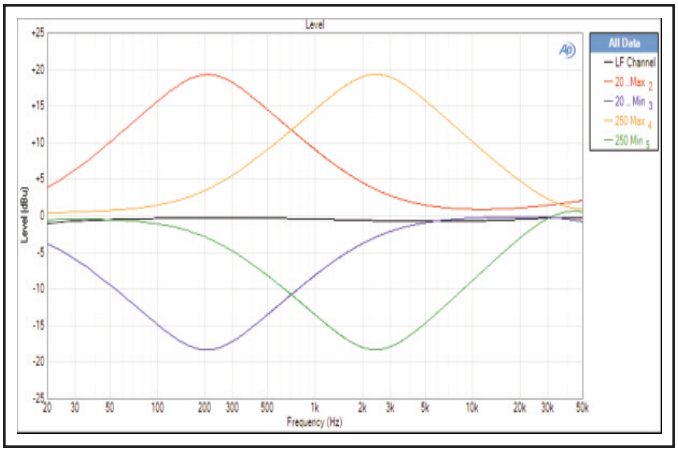


FIG. 9 Frequecy sweep LF Q 0.4 shift x 10

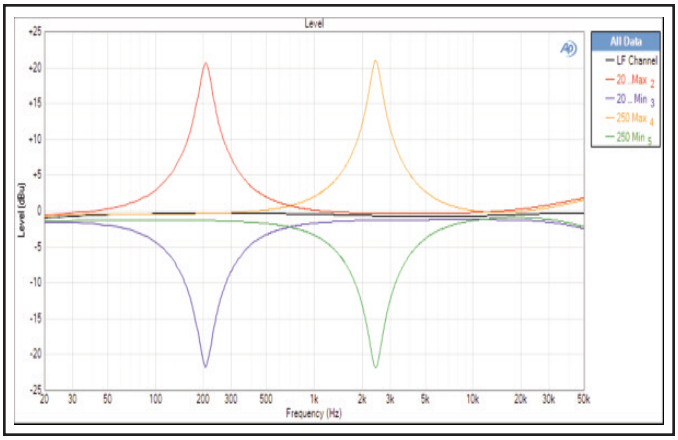


FIG. 10 Frequency sweep LF Q 4 shift x10

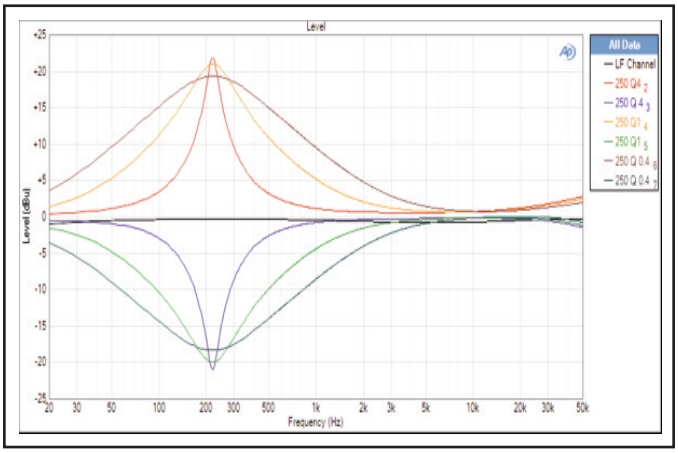


FIG. 11 Sweep of Q

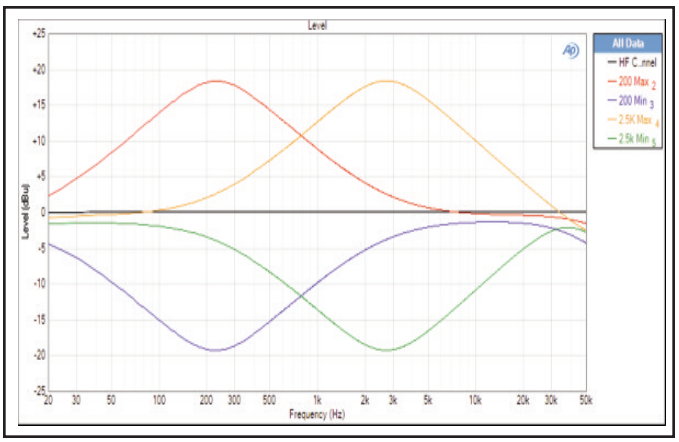


FIG. 12 Frequency sweep HF Q 0.4

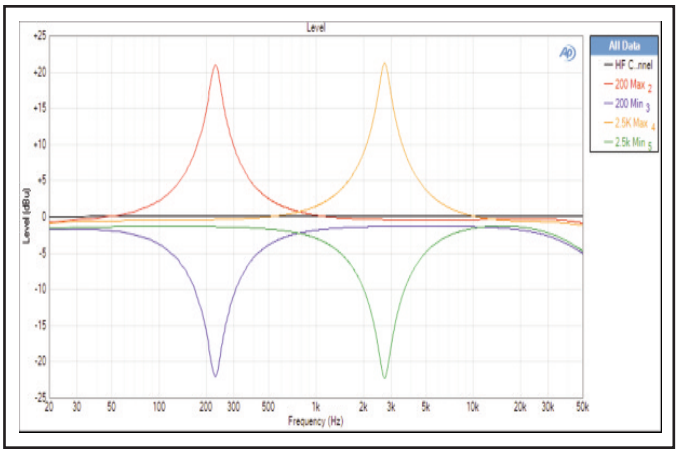


FIG. 13 Frequency sweep HF Q 4

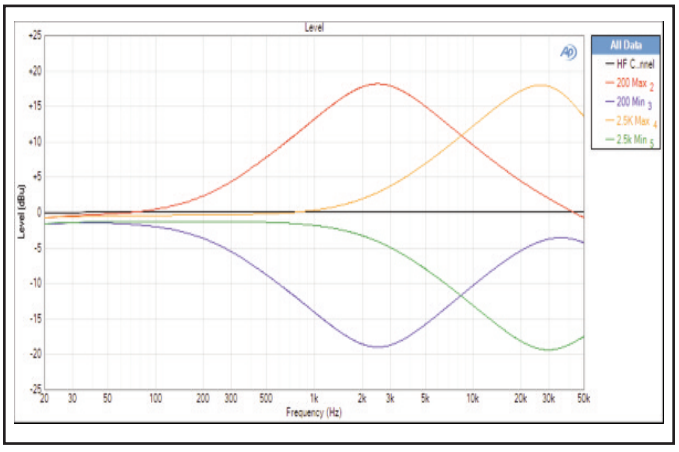


FIG. 14 Frequency sweep HF Q 0.4 shift x10

well under 1% up to 2 Vrms. Thereafter, the natural tube compression serves as a soft limiter, thus making even higher amounts of distortion tolerable due to the ratio of generated harmonics (we know this as that "warm" tube tone).

Referring to *Fig. 5*, I cranked the input gain control up to noon and repeated the set of output tests. As *Fig. 5* illustrates, the gain is steady and linearly tracks the input level for input levels up to about 1 Vrms with the gain control set to about noon for both the solid state (red) and tube (blue). Similarly, *Fig. 6* illustrates that gain is steady and linearly tracks the input level for input levels up to about 200 mVrms with the gain control set to its maximum clockwise position for both the solid state (red) and tube (blue).

The Equalizer

The TD-1 features two parametric equalizer bands. Each equalizer band includes a frequency select control, a gain control (boost or cut) and a Q control. Each band also includes a x10 switch that shifts the frequency range by a factor of 10. See the STT-1 review for an explanation of parametric equalization. Regardless of whether one or both bands are used, the equalization stage places only a single amplifier in the signal path.

Referring to *Figs. 7* and *8*, the low-channel frequency sweep is illustrated at the extremes of frequency and Q. *Figs. 9* and *10* illustrate the same settings as *Figs. 7* and *8* respectively, with the x10 frequency shift engaged. *Fig. 11* illustrates a single frequency where the Q setting is swept.

Referring to *Figs. 12* and *13*, the high-channel frequency sweep is illustrated at the extremes of frequency and Q. *Figs. 14* and *15* illustrate the same settings as *Figs. 12* and *13* respectively, with the x10 frequency shift engaged. *Fig. 16* illustrates a single frequency sweeping the Q setting.

Referring to *Fig. 17*, with the equalizer stage flat, I compared the solid state (red) to the tube (blue) input. I did not attempt to level match between solid state and tube to see the difference between the amplifiers. At the selected settings, the solid state is ruler-flat from about 20Hz out well past 50kHz. The tube amplifier provided just under 1dB less gain than the solid state amplifier. The low end is electrically similar to the solid state amplifier. However, the tube amplifier does not have the same

degree of linearity as the solid state amplifier when extended out to 50kHz for the given test conditions. Rather, the signal drops off about 2dB.

Performance

Referring to *Fig. 18*, I ran a test to measure the distortion products to compare the solid state (red) and tube (blue) amplifiers for a given input stimulus. Both show a reasonably linear response at +10dB, even out towards 50kHz. With regard to the solid state channel, the second harmonic (in orange) is slightly higher than the third harmonic (seen in light purple). Comparatively, the second harmonic of the tube stage (seen in green) is about 35db stronger than the third harmonic (dark purple). The relatively stronger emphasis of second harmonics in the tube amplifier is consistent with the other tests performed herein, and is a tell-tale sign of the tube topology. This is just one of the reasons that having *both* the solid state stage and the tube stage is cool.

Reamping

"Active sources," such as outputs from recording equipment, provide an extremely low-output impedance, compared to instruments. This sometimes causes instrument amplifiers to sound unusually clean. To address this, the REAMP 1 and REAMP 2 outputs provide level matching and impedance matching to mimic instrument pickups.

The REAMP 1 and REAMP 2 outputs provide passive guitar-pickup emulation via John Cunibertis patented REAMP technology (which he sold to Radial; Millennia as a licence). More particularly, Millennia suggests that REAMP 1 output can be used to effectively emulate the output characteristics of Stratocaster style single-coil pickups, whereas REAMP 2 output can be used to effectively emulate Les Paul style dual-coil "hum-bucking" pickups. Both the REAMP 1 and REAMP 2 outputs can be used simultaneously.

Referring to *Fig. 19*, the outputs are illustrated to demonstrate the differences between the balanced, unbalanced, REAMP 1 and REAMP 2 outputs. The balanced output is in black. The unbalanced output is in blue and mirrors the balanced output, with less gain, as would be expected. The REAMP 1 output is in red and exhibits a characteristic transformer resonant peak at around 200Hz. The second REAMP output is substantially flat to a frequency of just over 50kHz, thus providing a different character tone for Reamping applications.

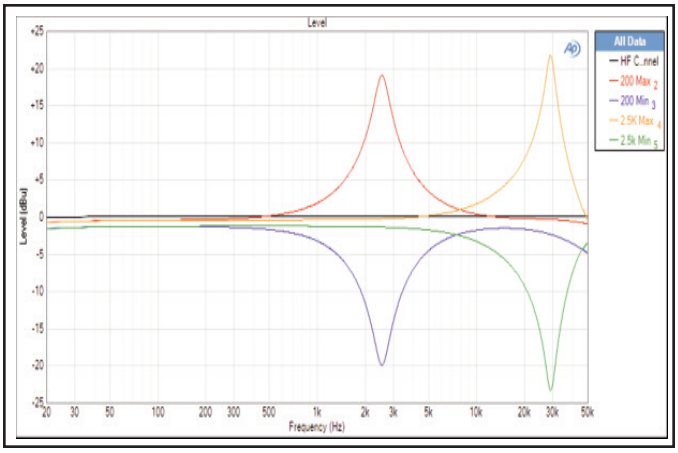


FIG. 15 Frequency Sweep HF Q 4 shift x10

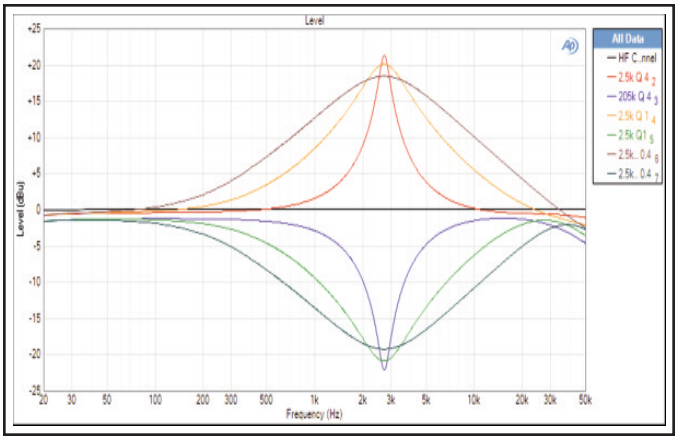


FIG. 16 Sweep of Q

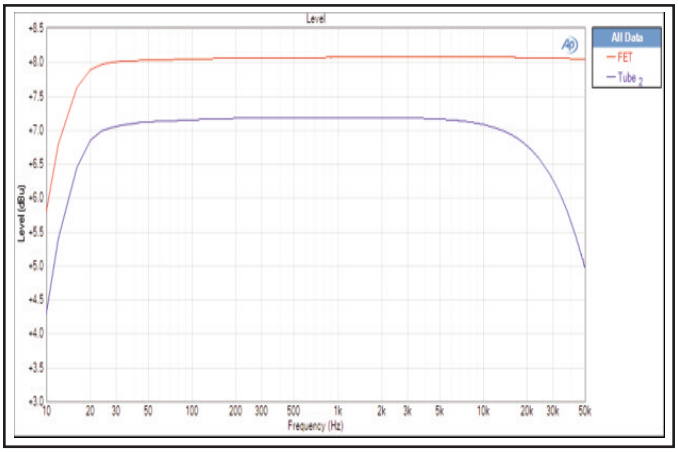


FIG. 17 Extended frequency response

AD200B

Our flagship all-tube bass head. Powerful, dynamic, and brilliantly responsive, this amp makes it easy to dial in modern and vintage bass tones.

TB500 TB1000

Terrorizing tone and volume with a tiny footprint. Massive Class D punch powered by a 12AX7-driven preamp section.

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Conclusion

There is a lot to like about Millennia products in general, and the TD-1 in particular. Having a recording tool that also provides a flexible equalizer and gain stage that can be used live cannot be underestimated. For instance, the TD-1 can function as an awesome direct box, with the added bonus of two bands of Millennia's parametric equalization. I am particularly fond of the three impedance options. The use of loading presents an opportunity to shape the sound without injecting a bunch of circuitry into the signal path, which I find useful and completely in line with Millennia's mantra of keeping the signal path clean. While it appears from my electrical tests that the TD-1 is all about transparency, detail and accurate representation, I would have liked to have seen at least some feature that is intended for "color," such as the transformer provided on the STT-1 Origin. Having the ability to "dirty up" the signal is sometimes useful, especially when getting creative, which is likely to happen if you embrace the power of the soak and REAMP capabilities built into the TD-1. BGM

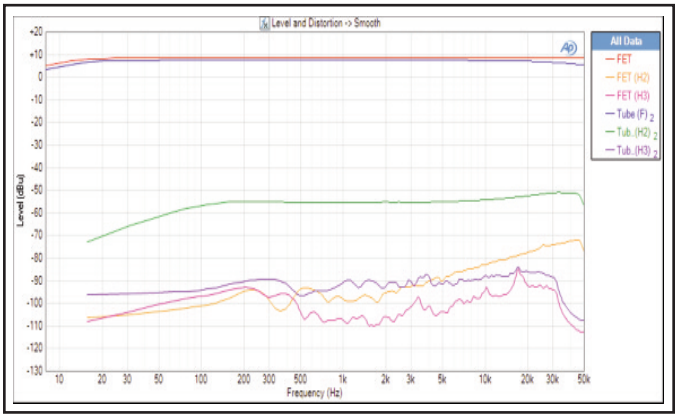


FIG. 18 Comparison of distortion tube and solid state

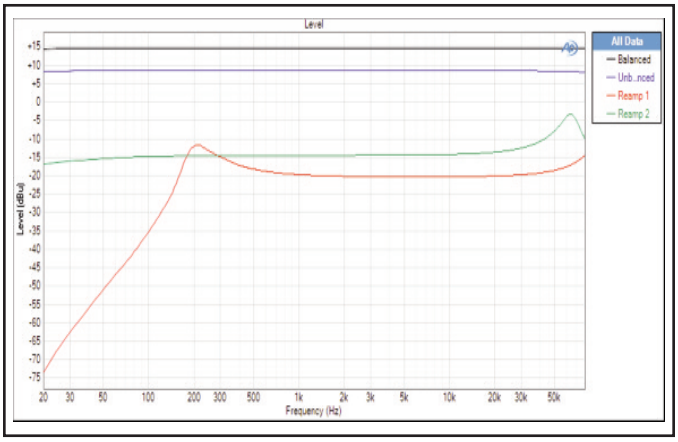
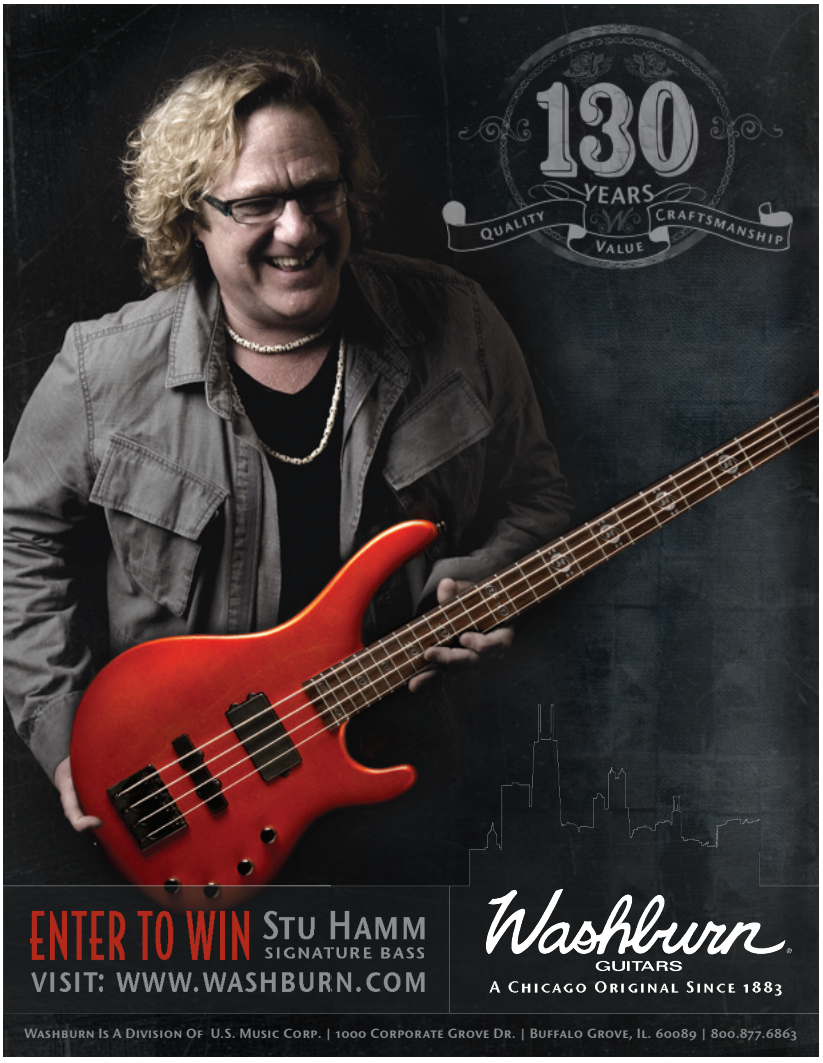


FIG. 19 Output comparison



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